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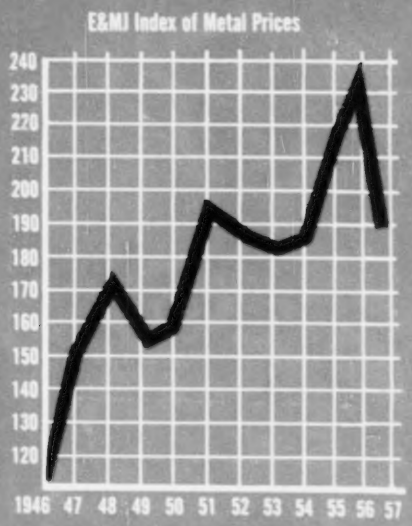

89TH Annual Survey And Outlook

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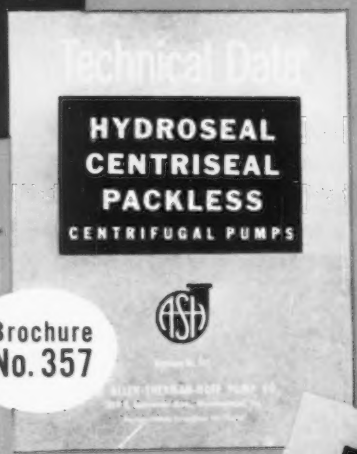

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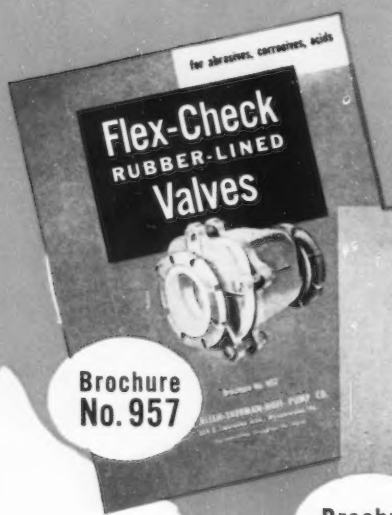

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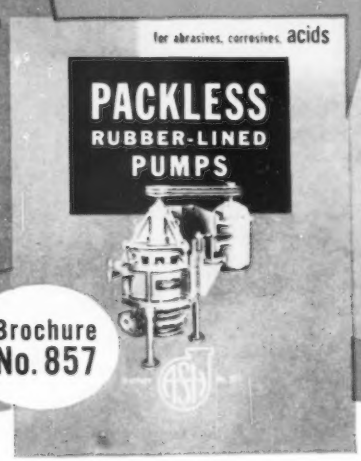

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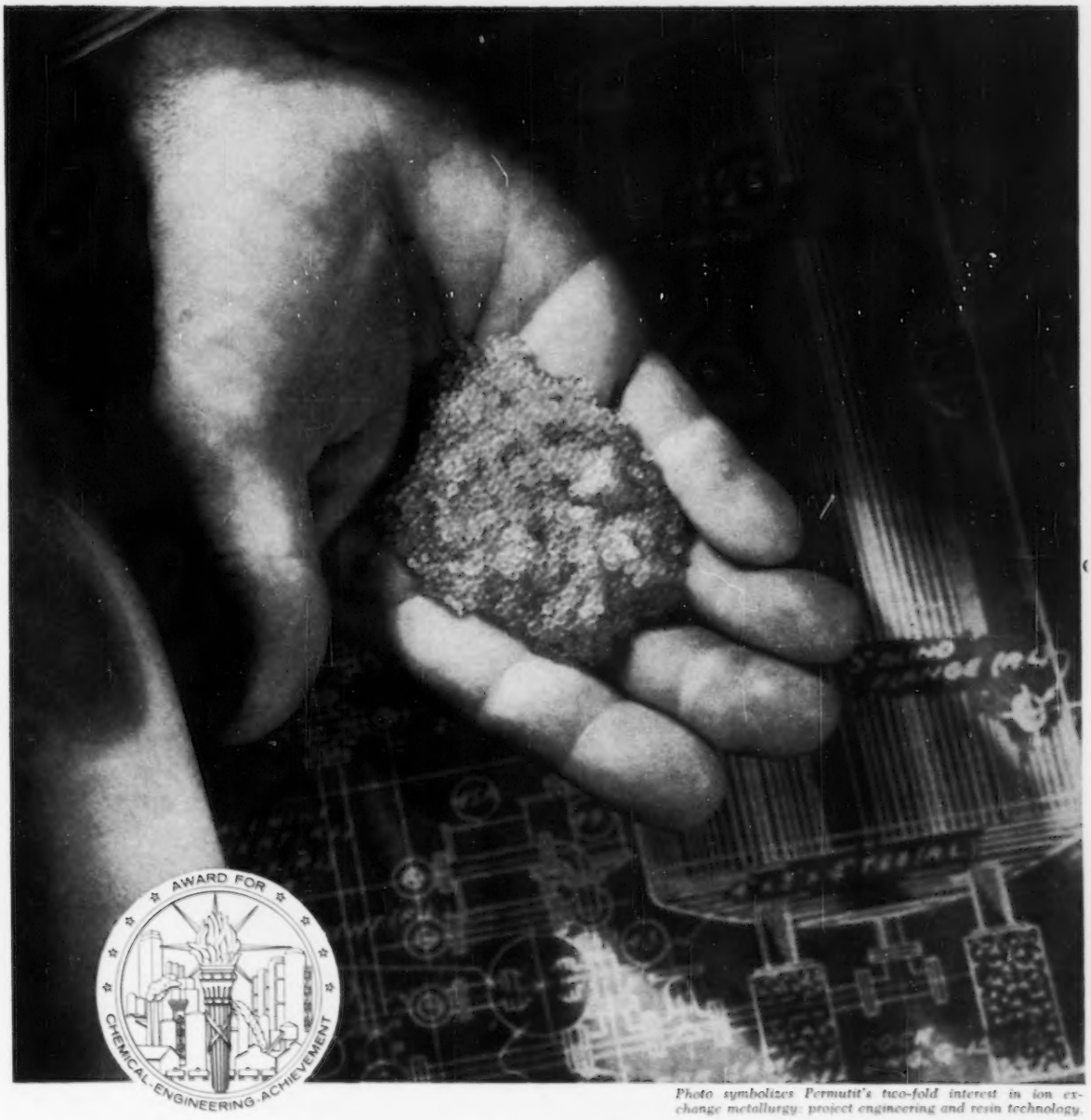

Photo symbolizes Permutit's two-fold interest in ion exchange metallurgy: project engineering and resin technology.

Pioneering in ion exchange metallurgy

• **The first five** ion exchange plants for extracting uranium on a production basis were designed by Permutit engineers. The first of these has been producing uranium since October, 1952. All of these pioneer ion exchange plants—and many other large Permutit-designed installations in South Africa, Belgian Congo and Canada—are producing at high efficiency.

Six out of seven of the top-producing U. S. uranium mills using the resin-in-pulp process now depend on Permutit SKB ion exchange resin. Permutit SKB provides high uranium capacity and efficient recovery under production conditions. It was developed by Permutit resin research especially for uranium extraction.

This record shows that Permutit is in ion exchange metallurgy "with both feet" . . . in both process engineering and resin chemistry. And Permutit's research program in this field promises important new developments on both fronts.

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92nd YEAR OF PUBLICATION

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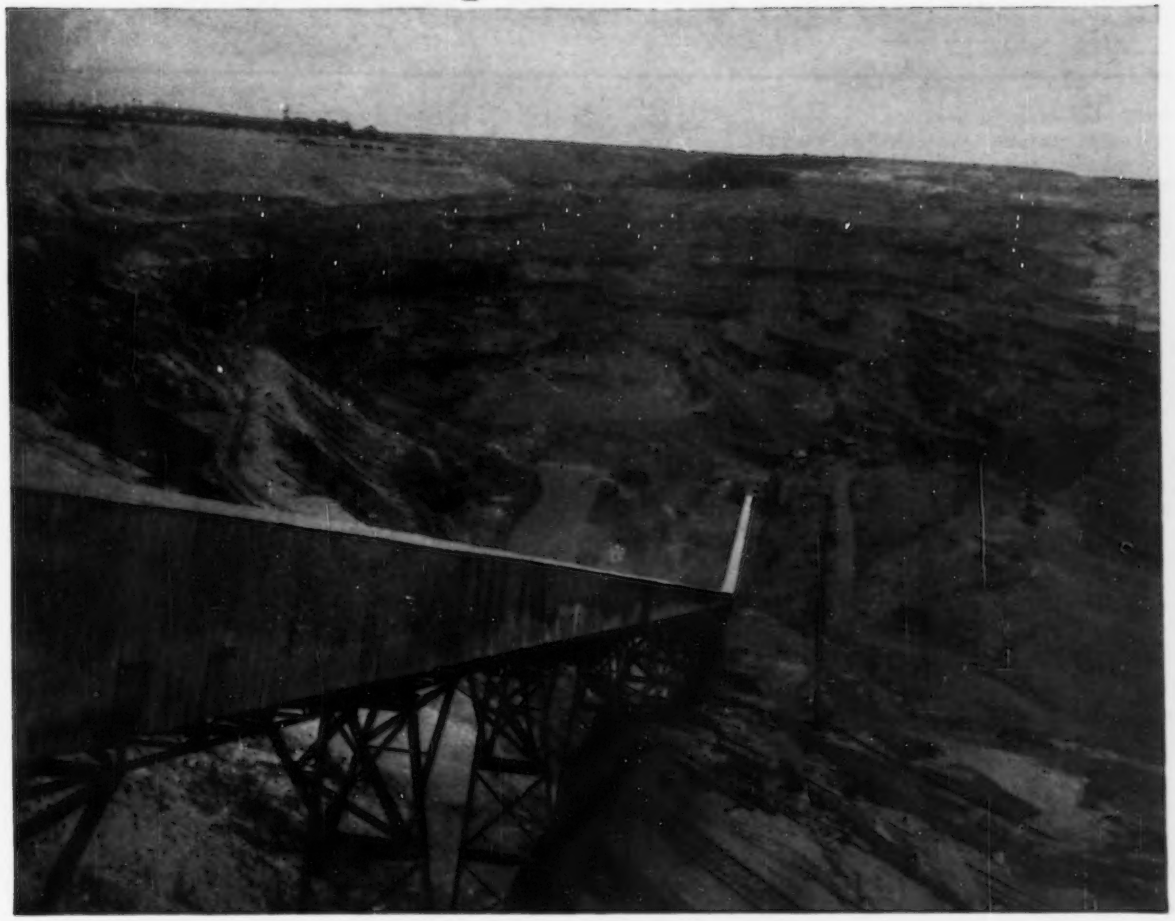
B.F.Goodrich report:



One belt does the work of 3 on high lift, long distance hauls

Oldest steel cord belt on Iron Range now in its 10th season

Problem: It's over a third of a mile and a 340-foot lift from the bottom of that iron ore mine up to railroad cars. Getting ore out of a deep pit like this used to take a series of three or more conveyor belts. No one belt could be strong enough for the job without being so heavy and stiff it would be impractical.

What was done: B.F.Goodrich engineers went to work on the problem, and developed steel cord construction. In this exclusive conveyor belt design, individual steel cords run lengthwise, each completely surrounded by rubber. These parallel cords give tremendous strength, yet are flexible so that troughing is natural, belt keeps centered on idlers, spillage is held to a minimum.

Savings: With steel cord construction, one conveyor belt now does the job of three or four belts on high lift, long distance installations. Money is saved, maintenance reduced, because the steel cord belt eliminates the transfer points necessary with a conveyor system built in several stages with ordinary belts.

Extra benefits: The B.F.Goodrich steel cord belt installed here has been at work 10 seasons now, hauling 1000 tons of ore an hour up and out of the pit. It has lasted longer than any conveyor belt ever made with steel cords or cables.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B. F. Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-283, Akron 18, Ohio.*

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INDUSTRIAL PRODUCTS

Behind the By-Lines...

Well, where have we been? Looking back at the late and generally unlamented year, 1957 discloses paradoxes, disappointments and, as always in this most fascinating of businesses—new challenges.

To bring you this 89th Survey and Outlook (and the title is more applicable than ever) we've gathered some pretty impressive horsepower.

Specialists from the Bureau of Mines, under the direction of Charles Merrill and Paul Yopes, once again provide the backbone of our survey. More industry representatives than ever have contributed their views and forecasts. And the *E&MJ* staff went out and beat a few bushes, too, to get the story of 1957—And From Now On.

We've taken Lewis Carroll's admonition for our own little keynote in this world behind the looking glass. "The way to begin is to begin."

Editor Al Knoerr, who has been doing some long-range forecasting at most of the major industry meetings for some time now, gives you a capsule version of his talks on page 109. If somebody asks you "Whither mining?", hand him those three pages, smile politely, and say "Thither."

We particularly direct your kind attention to the tables which accompany the copper review and those on pages 170 through 176. They reflect one of the most accurate views of mining today that is to be found.

That impressive horsepower we mentioned earlier is augmented in our "This Month in Mining" section, as well as in "Markets" and "Outlook."

We asked *E&MJ* news bureaus and correspondents to gather all the year-end data available for their monthly news. We've played it first in each regional news report to give you production from states and mining areas to go with the more detailed commodity writeups in the feature section.

And, to really bring you up to date, Markets, Outlook and "As we went to press" fill in the late gaps.

Go to it, lads.

One of the most difficult challenges of the author's job is following the ancient warning, "Make it simple, brief and clear—say what you've got to say and then stop." The following work, by the daughter of our predecessor in this spot, is ample proof that "a child can do it." What bothers us now is the awful realization that this child can do it better. Herewith, "Months", an original piece by Miss Anne Lutjen, written, we gather, as an assignment in spelling class.

Months

I like all the months. I like January, February, March, April, May, June, July, August, September, October, November and December.

In December, January and February, and sometimes in March, I like to go riding on my sled.

In April there are about eight to eleven things I can't think of.

In May there are usually birthdays.

June is the middle or center of the year.

July and August are hot but not as hot as June.

In September autumn begins.

In October there is Halloween, when people scare each other.

In November there is Thanksgiving, where everyone eats turkey and are thankful to God.

In December there is Christmas. When it takes Monday, Tuesday, Wednesday, Thursday, and Friday to get ready.

A Scottish school official has told a convention of educators in Glasgow that the apostrophe should be dropped from the English language.

H. J. Meehan, headmaster of St. John's School, Edinburgh, said, "The apostrophe is utterly useless and could be dispensed with." He added that although the apostrophe is not indicated in the spoken language there is no difficulty in recognizing the intended usage of a given word.

This ideas fine as far as were concerned. Well go along with Mr. Meehan if hell explain to reporters OToole and ORiley why theyre shorn of punctuation. Itll go over big with publishers wholl save newsprint. Therere editors whod never know the difference. And it wont bother linotype operators who are wont to drop them anyway. (*Wall St. Journal*)

Our collection of signs and mottoes for home, office, mine and plant is burgeoning. Some of the best are taken from a pleasant outfit which publishes the "Epigag Calendar."

To wit: "We're not yes-men around here. We say no whenever the boss does" . . . . "The worst thing about human nature is people" . . . "It's no disgrace to be poor—but it might as well be" . . . "Early to bed and early to rise, and you'll never meet important guys" . . . . "You can fool most of the people most of the time—and that's all that's necessary."

Solution of a 50-year riddle has been announced by the Russian publication *Znaniye Sila*, with notice that Soviet scientists have learned the fate of the Tungussky meteorite.

We've been tossing and turning, night after night, for years, muttering to ourself in crowded elevators—"What's the answer to the Tungussky meterorite? Where did it go?"

Well, sir, Ivan and Dmitri have come up with the answer. Ol' Tungussky exploded and evaporated when it plowed up some Czarist real estate in the neighborhood of the Podkamennaya Tunguska River. One (unexplained) un-evaporated chunk is now reported to contain 7- to 10% nickel. Now we've got a new problem. "Where did it come from?"

Life with our old friend the beachcomber becomes more and more exasperating. We are in receipt of a query scrawled on the back of a damp cocktail napkin in his script. "How did the fool and his money get together in the first place?"

EXCLUSIVE CATERPILLAR "HI-ELECTRO" HARDENING MAKES STEEL TOUGH TO BREAK, HARD TO BEND

Result: New CAT Scraper and 'Dozer cutting edges, built to withstand increased demands of today's machines, are top buy.

The cutting edge of a bulldozer or scraper takes more punishment than any other part of the machine. And more punishment today than ever before. New, larger, more powerful machines make greater demands on cutting edges.

New Caterpillar cutting edges match the superb quality and performance of Caterpillar earthmoving equipment. They are built to stay on the most grueling jobs, day after day, without breaking or bending. There is no better buy at any price.

Field tests prove that the new Cat cutting edges not only outwear other make edges of the same thickness; they even outlast the thicker edges of other manufacturers.

To manufacture such tough edges, Caterpillar engineers perfected a hardening process to give steel the right blend of toughness and hardness—toughness to prevent breaking, hardness to prevent bending and rapid wear.

ROUGH JOBS like this put cutting edges to severe test. And here is where tough Caterpillar edges prove their superiority.

A quality edge starts with quality steel, tested in Caterpillar's laboratories for the right chemical composition and physical characteristics. Only steels meeting these exact specifications are accepted, and further tests are made at every stage of production.

Edges are heat treated by "Hi-Electro" hardening, a Caterpillar exclusive. This gives a deep, super-hard wear case. The core is left tough. The finished edge has an armor-like case and a shock-absorbing core.

Your Caterpillar Dealer has full information about the new Cat Scraper and 'Dozer cutting edges. See him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CROSS SECTION of edge showing armor-like case and its shock-absorbing core.

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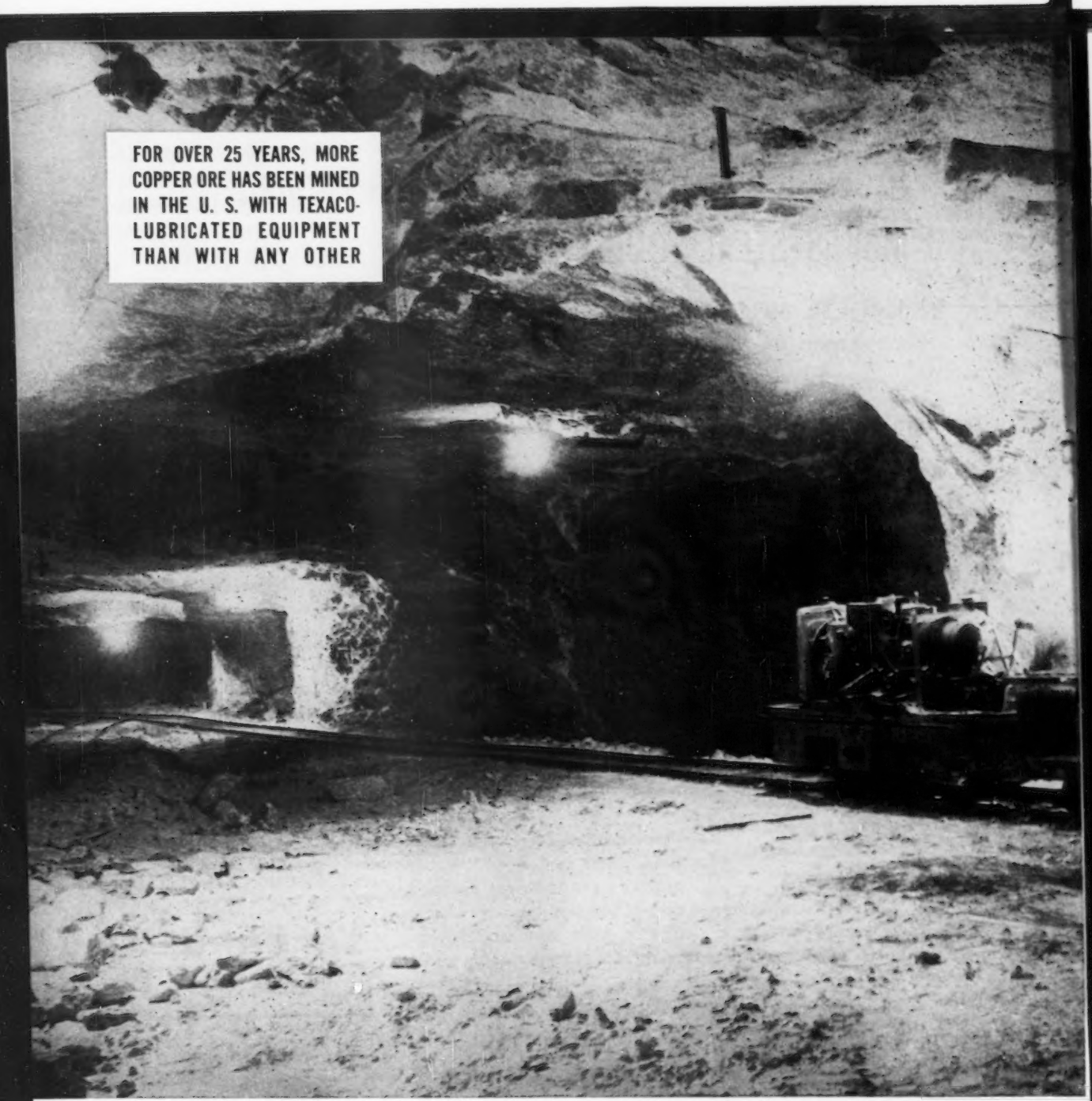
"HI-ELECTRO" hardening machines at the Caterpillar factory give cutting edges the strength to resist breaking and bending.



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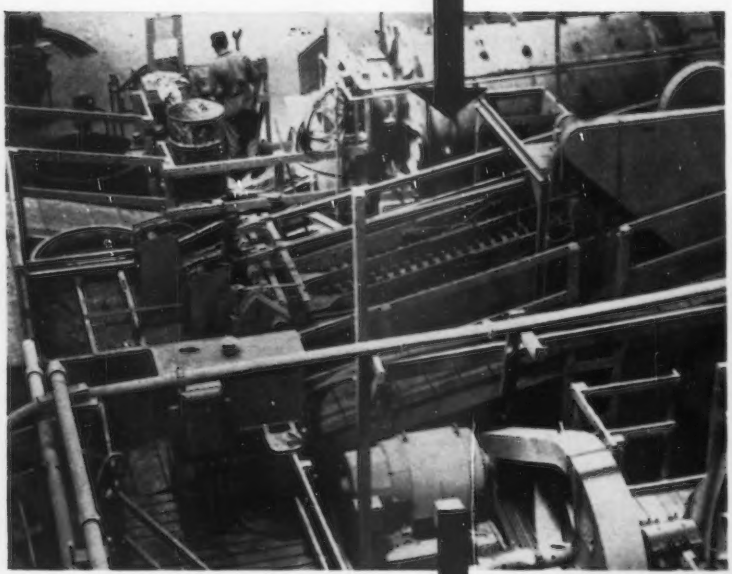
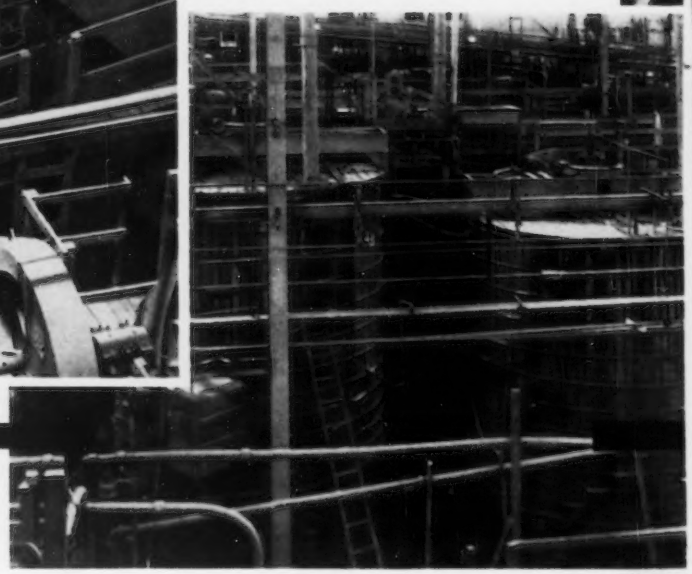
Uranium Ore at Rare



1. GRINDING — DSF Rake Classifier in closed circuit with rod mill, design overflow 540 tpd containing 260 tpd solids.



2. AGITATION — Type AA Airlift Agitators in acid leach circuit, feed 540 tpd at 48% solids.

Photographs are arranged in flowsheet order to illustrate the major treatment steps from primary grinding to Resin-In-Pulp process.

Located in the desert outside of Tuba City, Arizona, Rare Metals Corporation of America, at their new 260 ton per day Uranium Ore Concentrator, is making skillful use of Dorr-Oliver equipment and techniques in the sand-slime separation circuit prior to Resin-In-Pulp process.

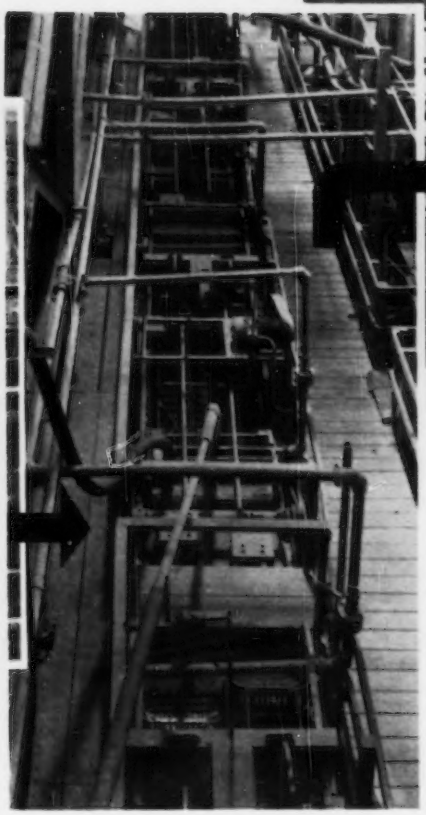
Dorr-Oliver units employed consist of one 6′ wide x 30′ long Type DSF Rake Classifier in closed circuit with rod mill preparing the non-carnotite sandstone feed for the thickening and leaching steps. In the slimes acid leaching circuit, there are two 14′ x 14′ Dorr Type AA Airlift Agitators. Four 4′ wide x 20′ long Type DSFRA Washing Classifiers wash the coarse sand fraction in counter current wash, lead Classifier overflow is cycloned in two stages consisting of three 6″ FRS DorrClones in each stage for further reduction of slimes to the RIP step.

Other D-O units include one 40′ dia. Type AA Thickener and one 30′ dia. Type A Thickener used for handling reclaimed mill water. In addition, Rare Metals has also installed several Dorr Type V Suction Pumps for metering of Thickener underflow.

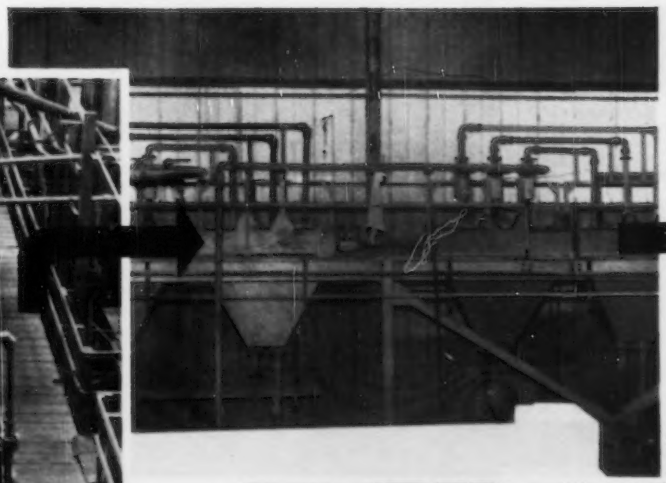
The know-how behind each unit of Dorr-Oliver equipment for the processing industries is based on worldwide experience. Whether your requirements be for individual equipment or complete design and consulting service, D-O can be of help to you.

For complete information, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

Beneficiation
Metals



3. WASHING — Acid leach residue is washed in Neoprene lined DSFRA Classifiers, separation made at 100 mesh.



4. DESLIMING — FRS DorrClone overflow derived from Classifier overflow provides 900 tpd of slurry at 10% solids to RIP Process; sand tails 236 tpd at 72% solids, separation made at 325 mesh.

5. WATER RECLAMATION — Type A Thickener handles 120 tpd of reclaimed mill water.

DorrClone — T.M. Reg. U. S. Pat. Off.

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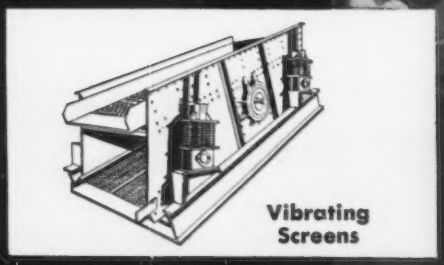
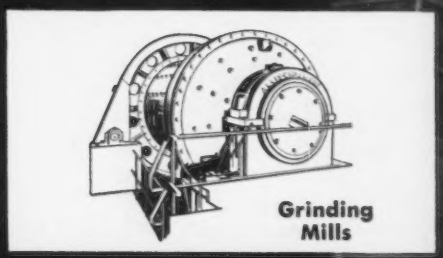
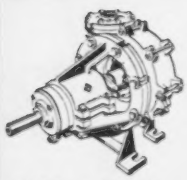


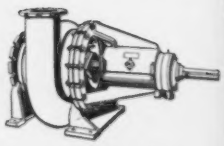
Vibrating Screens



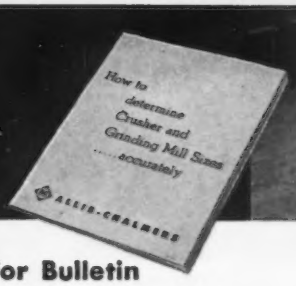
Grinding Mills



Rubber-Lined Pumps



Solids Handling Pumps



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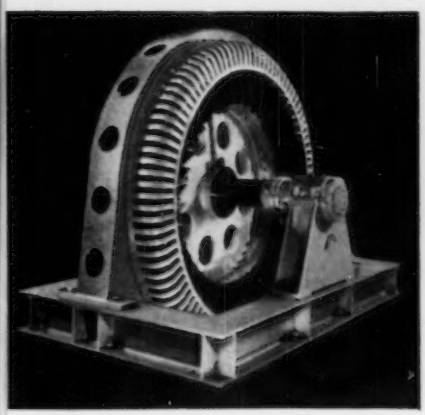
CRUSHERS, grinding mills, screens, pumps, generators, switchgear, transformers, motors, drives, control — *Allis-Chalmers builds them all.* And out of this unequalled diversity has come the unique ability to "coordineer" machinery and equipment for a complete process—yes, even for an entire plant.

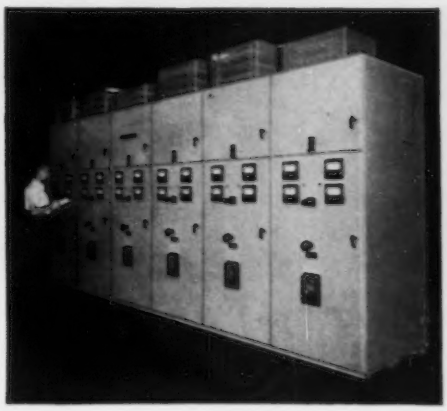
How it Works

Allis-Chalmers maintains separate departments staffed by research, design, manufacturing and application specialists for each product. "Coordineering" results from an interdepartmental exchange of ideas and technical information correlated in *one department specializing in mining applications.* In this department components are matched to meet the requirements of your job. New as well as existing equipment in your plant is integrated into a smooth, productive, profitable operation. And, of course, Allis-Chalmers assumes undivided responsibility for efficient performance.



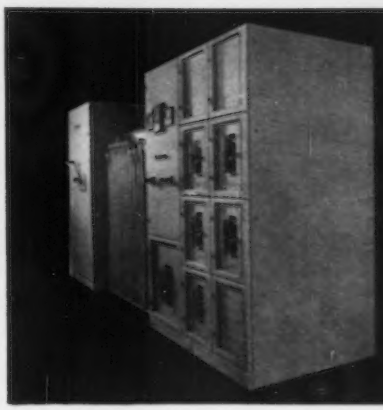
Motors

Allis-Chalmers builds a complete line of motors from ½ horsepower and up. Applying the "work index" formula, Allis-Chalmers engineers can help you determine the required power input and apply the right size motor needed for maximum efficiency and economy.



Control

Starter illustrated features circuit designed to cut crusher downtime. Overload protection is provided by two sets of thermal overload relays. One set operates on slight overload to sound warning. Second set stops motor when temperature reaches the danger point.



Unit Substations

Designed for maximum flexibility. Additions or replacements to basic centralized unit can be made conveniently at any time. Strategically located, unit substations bring high voltages near load centers — cut cable costs, minimize line loss, save space, provide complete protection.

CHALMERS

A-C ALLIS-CHALMERS

Hydroset and Texrope are Allis-Chalmers trademarks.

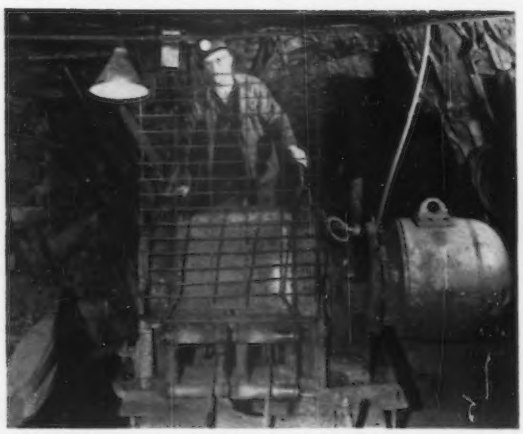
A-5406

underground or open pit...

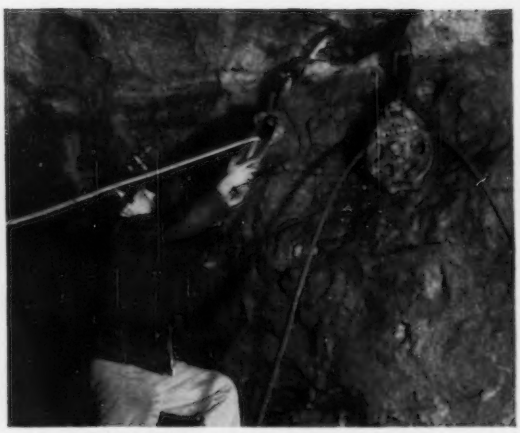
JOY HAS THE EQUIPMENT YOU NEED FOR *Economical* MINING

Whatever your mining methods, you need equipment that will reduce your cost per ton. As the world's largest manufacturer of mining equipment Joy has more years of engineering and production experience . . . designs and produces the most modern equipment for the latest in mining methods.

Select the equipment in which you are most interested . . . and write *today* for informative bulletins . . . ask for Data File 180-4.



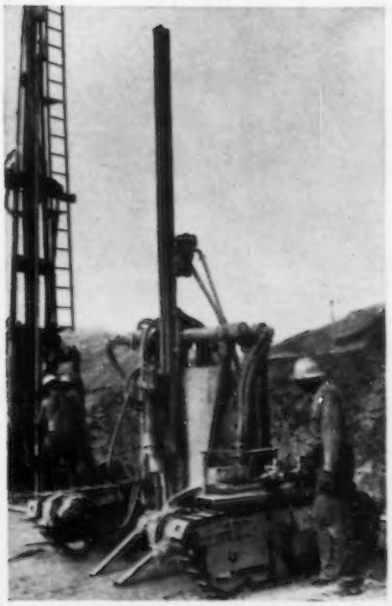
SLUSHERS Models, two and three drum, from 5 to 150 HP. Air or electric drive. Rope pulls to 17,700 lbs. Also single drum, portable hoists—air or electric drive with capacities to 3500 lbs.



SHEAVE BLOCKS Famous for non-removable locking pin. Sizes from 6 to 20 inches—rope sizes from ½" to 1¼".

CORE DRILLS Skid column or truck mounted models for underground and surface drilling. Capacities from 250 to 2250 ft. Also a complete line of supplies.

AIR LEG Powerful, easy to handle. All controls in drill backhead for one-hand operation. Feed lengths from 36" to 72".



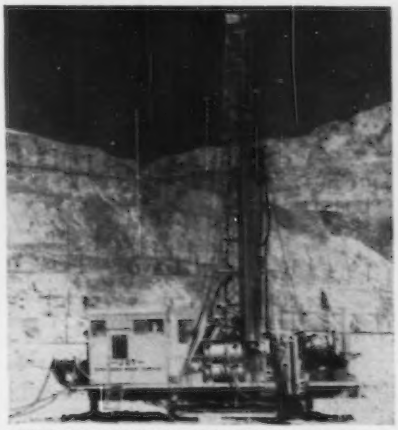
JUNIOR CHALLENGER BLAST HOLE DRILL CTM-1 Mounts 4½" drill —holes to 4"—completely power operated.

CHALLENGER BLAST HOLE DRILL TWM-5 Self-propelled—mounts 5¼" drifter—holes to 5" diameter, 40 ft. or more in hardest formations.

59-BH CHAMPION BLAST HOLE DRILL—Newest of the champions with hole size increased... 9" holes with round drill pipe.

DRILLMOBILES Rubber tired, self propelled jumbo with T-350 drills on Hydro Dill Jibs. Eight models-air, diesel, or electric driven.

TUNGSTEN-CARBIDE ROCK BITS Complete range of sizes. Threaded or taper attachment.



SUPER HEAVYWEIGHT CHAMPION BLAST HOLE DRILL 60-BH Self propelled rotary air blast drill holes from 9" to 12".

SHUTTLE CARS . . . 14-RC Designed for hard rock mining . . . electrically operated, hauls 15 tons up a 34½° grade. Diesel-mechanical version also available.

JOY... EQUIPMENT FOR MINING

For details write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Data File 180-4

...ASK ABOUT ALL THESE JOY PRODUCTS

Continuous Miners, Mobile Loaders, Shuttle Cars, Shuttle Car Elevators, Cutters, Cutting Machine Trucks, Drills, Conveyors, Belt Feeders, Post-Pullers, Timber Setters, Bits, Mine Fans, Portable Blowers, Mine Air Compressors, Roof Bolting Drills, Hoists, Core Drills, Core Drilling by Contract, Safety Circuit Centers, Cable Connectors, Vulcanizers, Rock Drills, Rock Bits, Hydro Drill Jibs, Air Compressors, Portable Lighting Lines.

See data on other Joy products in this issue.

WSW-M6679-180

NORDBERG MACHINERY

...engineered for large volume, quality production of ores and industrial minerals

The entire line of heavy-duty Nordberg Mining Machinery has been engineered and built for one basic purpose . . . to meet the mining industry's expanding demand for low cost, quality production and processing of large tonnages of metallic and non-metallic ores and industrial minerals.

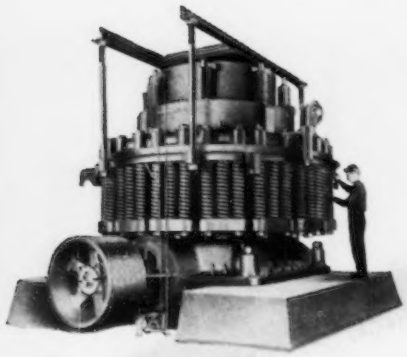
The many years of specialized experience gained by Nordberg in working closely with the mining fraternity has resulted in continual design and operational improvements which have consistently made Nordberg Machinery first choice among the world's leading ore and mineral producers.

As illustrated, Nordberg Mining Machinery includes Symons® Gyratory Crushers for primary breaking, Symons Cone Crushers for secondary and tertiary crushing, Nordberg Mills for wet or dry grinding, Symons Vibrating Grizzlies and Screens for scalping and sizing, and Nordberg Engines for mine and mill power.

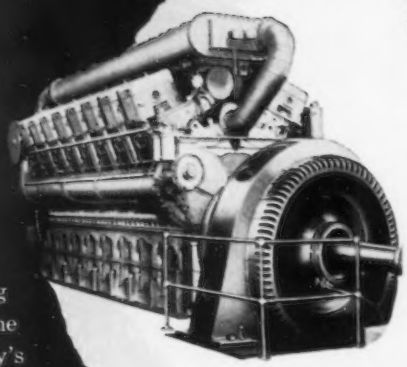
Write for literature on the Nordberg Machinery you need to efficiently produce large tonnages of ores and industrial minerals at lower cost per ton.

SYMONS . . . A Registered Nordberg Trademark known throughout the world

NORDBERG MFG. CO.
Milwaukee, Wisconsin



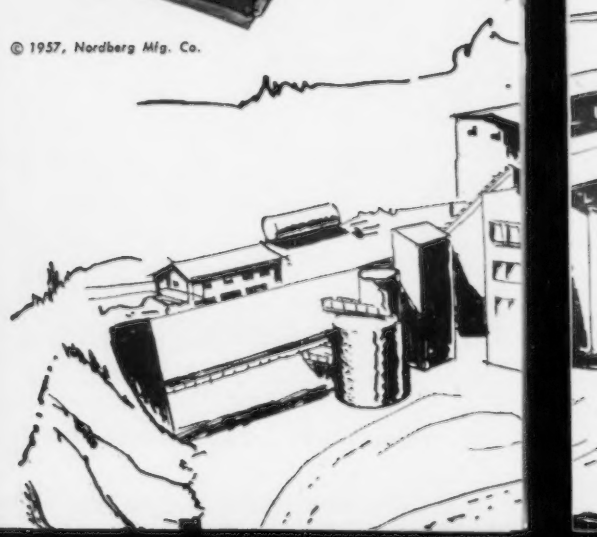
SYMONS CONE CRUSHERS
Built in both Standard and Short Head types, in sizes from 22" to 7' in diameter, in capacities from 6 to 900 or more tons per hour.



NORDBERG ENGINES
Ranging from small power units to large stationary engines. Nordberg engines are built in types for Diesel, Duafuel® and Spark-Ignition Gas operation, in sizes to over 12,000 horsepower.

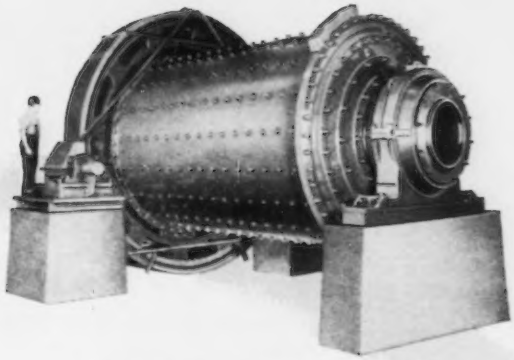
SYMONS ROD DECK SCREENS
Highly efficient screening surface of spring steel rods—easily replaced. Especially suited for wet, sticky materials.

© 1957, Nordberg Mfg. Co.



SYMONS® PRIMARY GYRATORY CRUSHERS

Built in 30", 42", 48", 54", 60" and 72" feed opening sizes, for capacities to 3500 or more tons per hour.

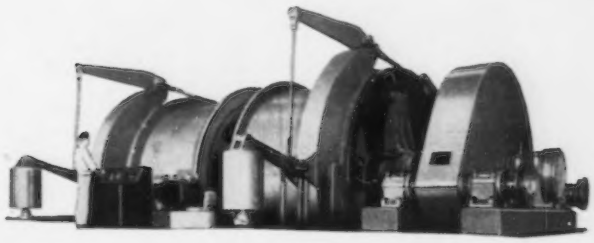


NORDBERG GRINDING MILLS

Built for wet or dry, open or closed circuit operation . . . including Rod, Ball, Pebble, Tube and Compartment types, in sizes from 6′ to 13′ dia., up to 50′ in length.

NORDBERG MINE HOISTS

Built in both friction and drum types for hoisting both ore and men. These dependable hoists are widely used in large coal and metal mining operations.

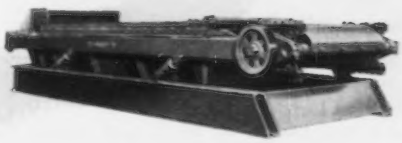


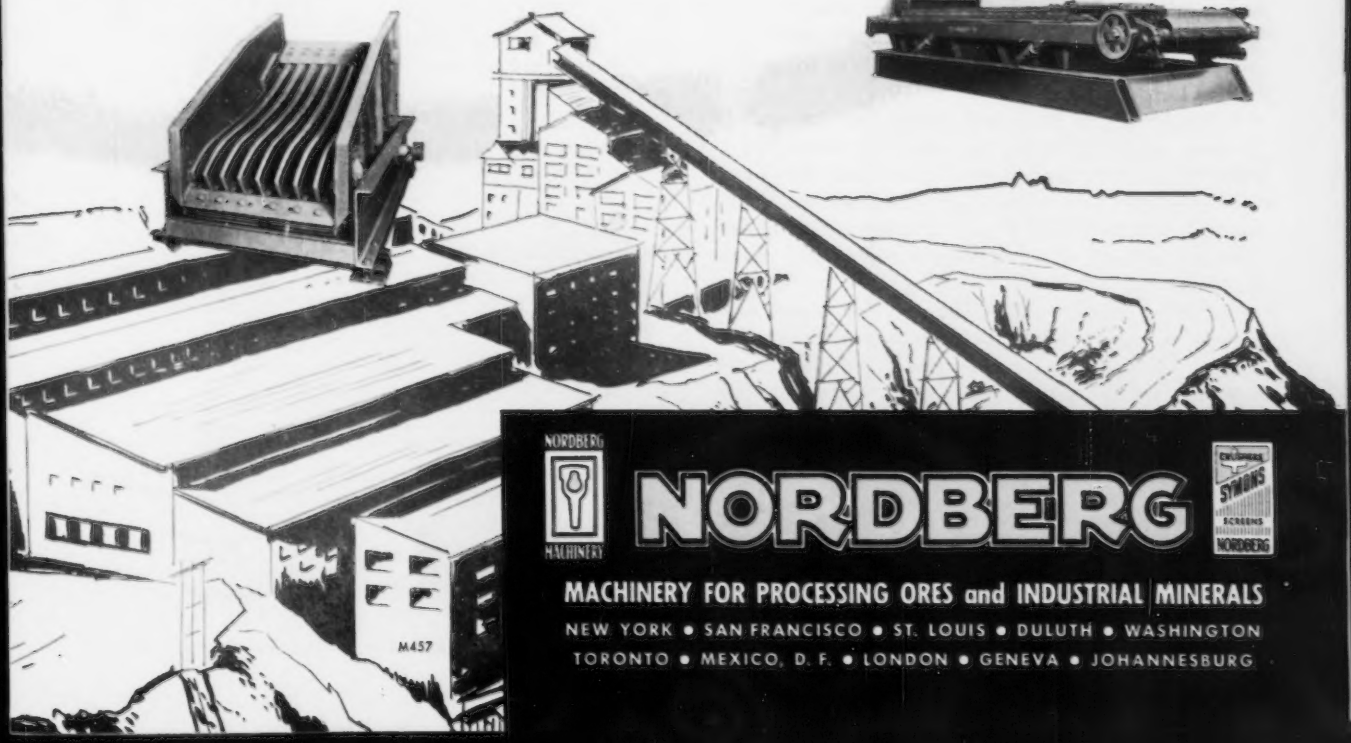
SYMONS VIBRATING BAR GRIZZLIES

Built for heavy duty large capacity primary scalping service. Particularly effective when handling wet, sticky or gummy ores.

SYMONS HORIZONTAL VIBRATING SCREENS

Permit level, large capacity screening of extreme accuracy. Built in single, double and triple deck types in a wide range of widths and lengths.





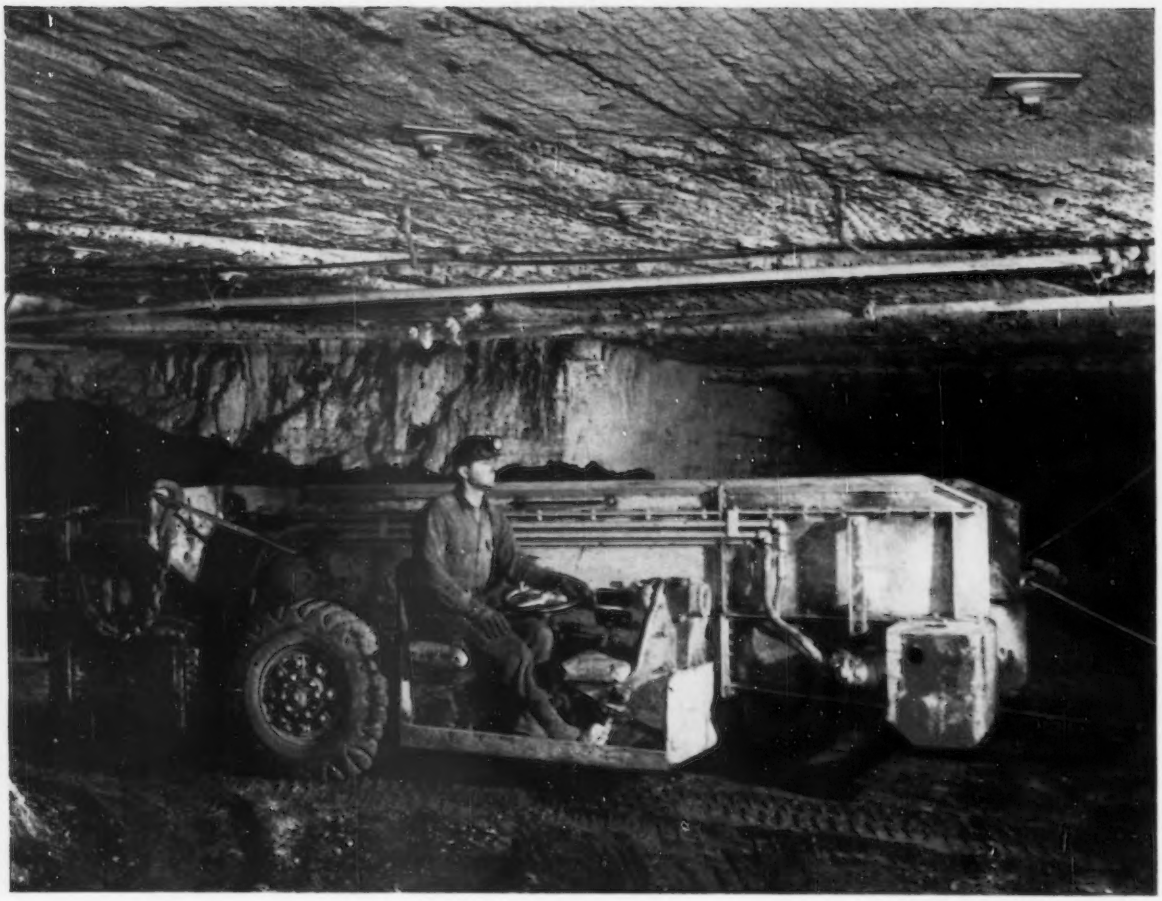
NORDBERG MACHINERY

NORDBERG

EXCLUSIVE SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON
TORONTO • MEXICO, D. F. • LONDON • GENEVA • JOHANNESBURG



How to bolt your roof...quickly

You can anchor your roof in jig time when you use Bethlehem square-head roof bolts equipped with expansion shells. Simply use your regular drilling equipment and an impact wrench.

Besides saving time, roof bolting does so much to promote safety by locking the overlying rock layers in place. With heavy timbers no longer taking up so much room, it's easier to move mechanized equipment. Ventilation is improved and fire hazards are reduced. And there's less need for large storage areas, both above and below ground.

The Bethlehem square-head roof bolt is used with a leaf-type malleable-iron shell, which is fastened to the leading end of the bolt. As the bolt is tightened in the hole, the leaves of the shell expand, locking the assembly in place. A square roof plate furnishes additional support. A hardened washer reduces friction which may occur between the bolt head and roof plate.

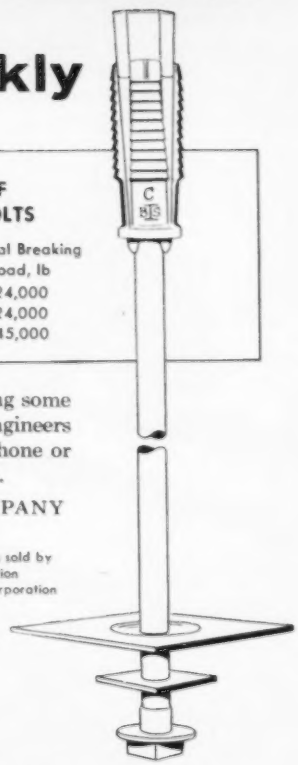
THREE TYPES OF SQUARE-HEAD BOLTS

Type	Diam. In.	Typical Breaking Load, lb
Carbon	¾	24,000
High-Strength	⅝	24,000
High-Strength	⅞	45,000

If you're thinking about doing some roof bolting, let one of our engineers give you full details. Just phone or write our nearest sales office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

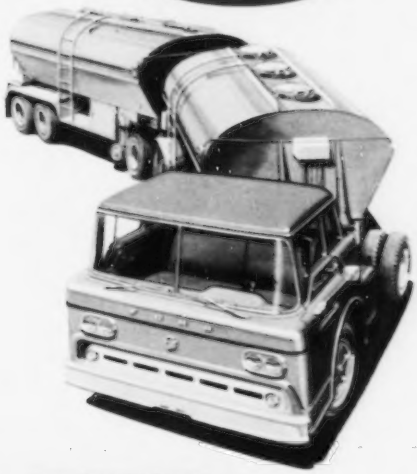
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation



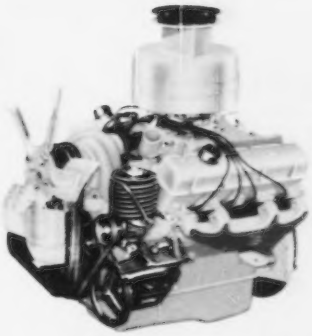
BETHLEHEM STEEL

FORD

1958 EXTRA HEAVY DUTY TRUCKS
WITH NEW SUPER DUTY V-8'S



C-850
C-950
C-1000
C-1100

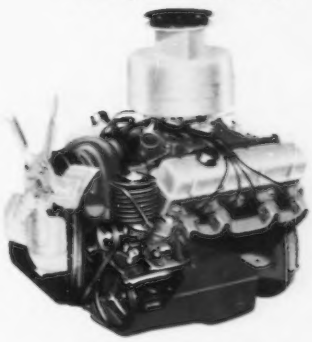


277-hp 534 SD V-8

F-850
F-950
F-1000
F-1100

260-hp 477 SD V-8

T-850
T-950



226-hp 401 SD V-8

BIG TRUCK BUILT...BIG TRUCK POWERED...AT FORD'S LOW PRICES!

FORD TRUCKS COST LESS

...LESS TO OWN ***...LESS TO RUN*** ***...LAST LONGER, TOO!***

NEW FORD EXTRA HEAVIES

FORD T-950 tandem dump truck with up to 51,000-lb. GVW, up to 277-hp Super Duty V-8 available. GCW 75,000 lb.

FORD C-1000 Tilt Cab tractor with big 260-hp Super Duty V-8 engine. Maximum GCW 65,000 lb. with optional axle. GVW 31,000 lb.

FORD F-1100 conventional with 277-hp Super Duty V-8 standard. Maximum GVW 36,000 lb. with optional 29,000-lb. rear axle.

Step in . . . the new Ford Extra Heavy Duty trucks for '58—the all-new, more rugged line with huge payload capacities for on-highway or off-the-road service. *Step ahead* with Ford's more-for-your-money features. Meet America's most modern *big* trucks for '58. Discover the new advances in this pace-setting Extra Heavy Duty line of Conventionals, Tilt Cabs and Tandems.

They're new in power, too! Ford now offers three mighty new Super Duty V-8's. Extra rugged, modern big engines with up to 534-cubic inch displacement . . . up to 277 horsepower! And "over square" (bore larger than stroke) Short Stroke design provides maximum power, durability and economy.

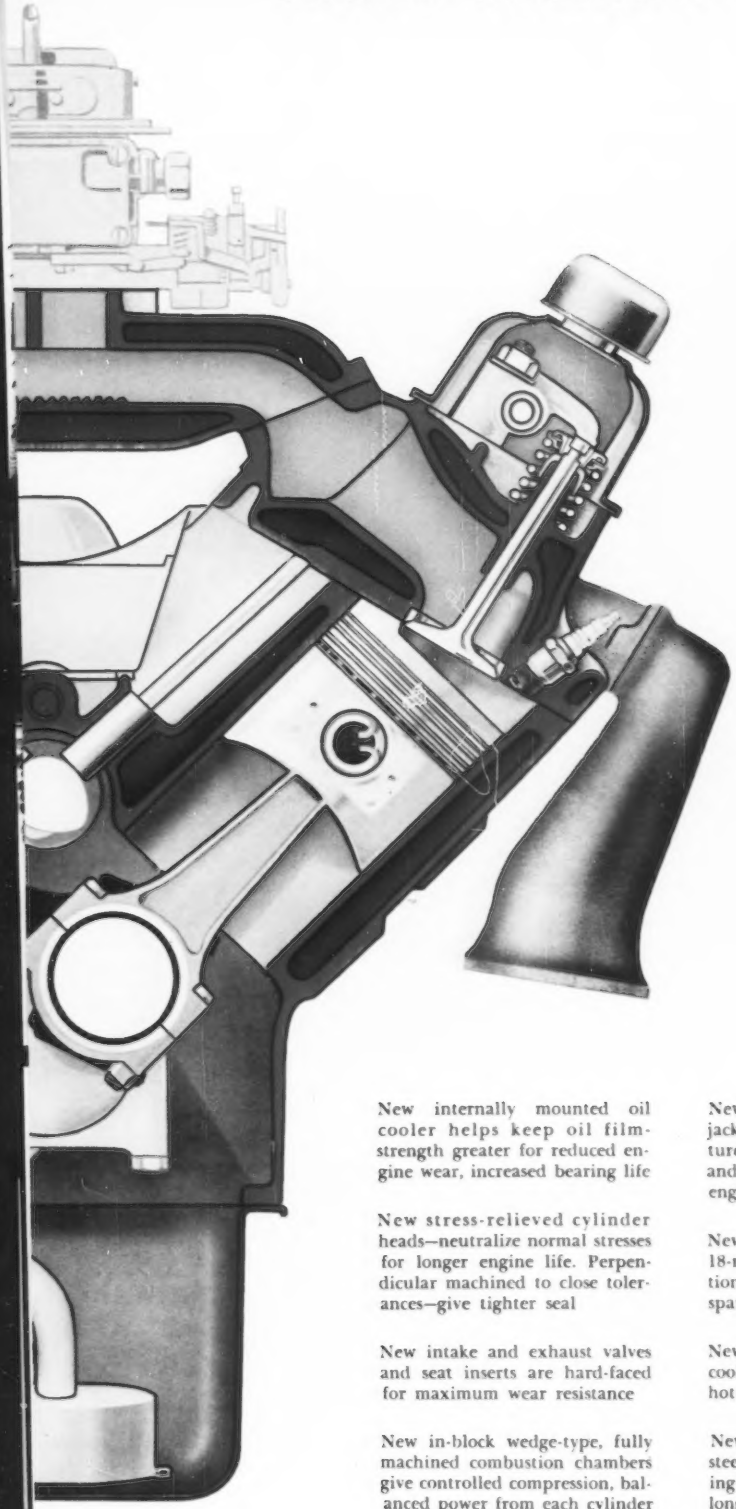
Saddle-type, step-type and cylindrical fuel tanks are available, complete with electric fuel pumps for extra dependability. Mighty Super Duty engines and Ford Extra Heavy Duty chassis form a combination of power and ruggedness that can't be beat. Springs, axles, brakes—all components are engineered to give exceptional service. All the new Ford advancements for '58 mean *Ford Trucks Cost Less* . . . less to own . . . less to run . . . last longer, too!

QUICK FACTS

CONVENTIONAL MODELS	ENGINE		REAR AXLE		MAX. TIRES	GVW'S (lb.)		GCW'S (lb.)	
	Standard	Optional	Standard	Optional		Standard	Optional	Standard	Optional
F-1100	277-hp 534 V-8		22,000 lb.	29,000 lb.*	12 x 24.5—12 PR	30,000	36,000	65,000	
F-1000	260-hp 477 V-8		21,000 lb.	22,000 lb.	12 x 24.5—12 PR	30,000		55,000	65,000
F-950	226-hp 401 V-8		21,000 lb.		12 x 24.5—12 PR	29,000		55,000	
F-850	226-hp 401 V-8		18,000 lb.		11 x 22.5—12 PR	25,000		50,000	
TILT CAB MODELS									
C-1100	277-hp 534 V-8		22,000 lb.	29,000 lb.**	12 x 24.5—12 PR	31,000	36,000	65,000	
C-1000	260-hp 477 V-8		21,000 lb.	22,000 lb.	12 x 24.5—12 PR	31,000		55,000	65,000
C-950	226-hp 401 V-8		21,000 lb.		12 x 24.5—12 PR	30,000		55,000	
C-850	226-hp 401 V-8		18,000 lb.		11 x 22.5—12 PR	26,000		50,000	
TANDEM MODELS									
T-950	226-hp 401 V-8	260-hp 477 V-8 277-hp 534 V-8	38,000 lb.		12 x 24.5—12 PR	46,000	48,000 51,000	75,000	
T-850	226-hp 401 V-8	260-hp 477 V-8 277-hp 534 V-8	34,000 lb.	28,000 lb.	11 x 22.5—12 PR	43,000	37,000 45,000	— 70,000	55,000 —

*Not available on 132" wb. model. **Not available on 99" wb. model.

Now from FORD . . . durable



Big, modern all-truck engines! Up to 534-cu. in. Displacement . . . 277 Horsepower for New Ford Extra Heavy Duty Models

New Ford Super Duty V-8's have up to 534-cubic inch displacements . . . up to 277 horsepower for rugged performance. Three great new "over square" (bore larger than stroke) Short Stroke V-8 truck engines for new Ford Extra Heavy Duty models. The most modern, most efficient gasoline engines in their field. They're ultra-modern . . . designed for today's hauling needs.

Engineered to develop more horsepower per pound, with rugged new durability features for longer-lasting dependability. And for routine maintenance their clean, simple design gives maximum accessibility for servicing. Powerful new Ford Super Duty V-8's have been thoroughly road tested by leading truck fleets, coast to coast . . . they're ready to bring you new power, durability and economy!

New internally mounted oil cooler helps keep oil film-strength greater for reduced engine wear, increased bearing life

New stress-relieved cylinder heads—neutralize normal stresses for longer engine life. Perpendicular machined to close tolerances—give tighter seal

New intake and exhaust valves and seat inserts are hard-faced for maximum wear resistance

New in-block wedge-type, fully machined combustion chambers give controlled compression, balanced power from each cylinder

New intake manifold—water-jacketed for stabilized temperatures . . . aids high horsepower and torque output, improves engine economy

New spark plug accessibility—18-mm. plugs with "Turbo Action" resist fouling, give positive spark action

New alternately spaced sodium-cooled exhaust valves reduce hot-spot dangers, last longer

New externally balanced, forged-steel crankshaft equalizes bearing loads for greater durability, longer bearing life

New Turbulence-Top pistons for maximum power, top ring groove carrier for extended groove life and thermal-controlled integral strut for better piston sizing

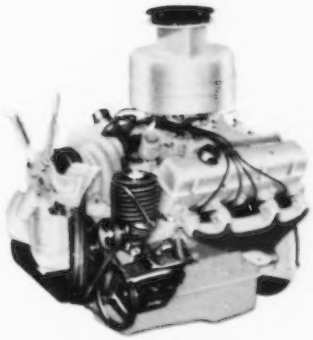
New, stronger "pyramid" connecting rods—hollow-milled for better balance

New extra-large Full-Flow oil filter—big 2-quart capacity for double filtering area

New high-capacity rotor-type oil pump mounted within the oil pan for more efficient lubrication system

FOR INDUSTRIAL ENGINE APPLICATION WRITE TO: INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION OF FORD MOTOR CO., P. O. BOX 598 DEARBORN, MICHIGAN

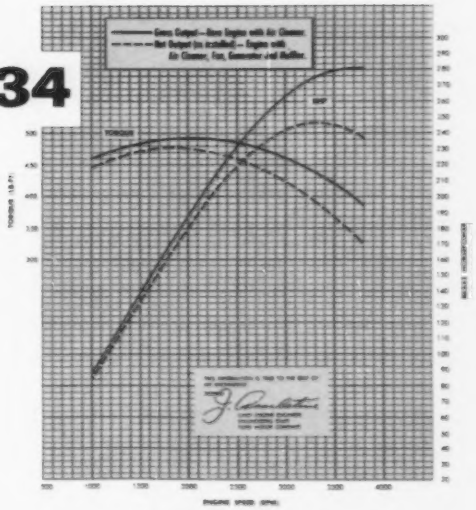
new Super Duty power



277-hp 534 SD V-8
Brake Horsepower—277 @ 3400 rpm
Torque—490 lbs-ft @ 1800-2300 rpm
Bore—4.50 in. **Stroke**—4.20 in.

534

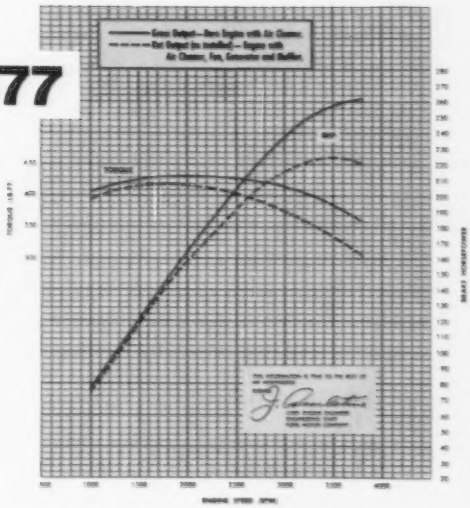
The big, new Ford 534 is an "over square" Short Stroke engine, like all Ford Super Duty V-8's. Here's snappy power, long-lasting durability and top economy. Standard in Ford F-1100, C-1100 trucks. Optional in T-850, T-950 tandems.

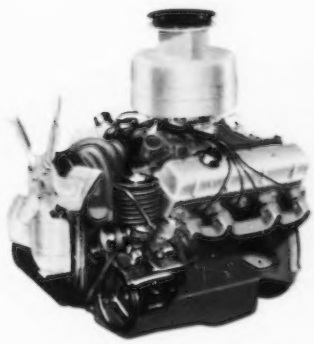


260-hp 477 SD V-8
Brake Horsepower—260 @ 3600 rpm
Torque—430 lbs-ft @ 1800-2300 rpm
Bore—4.50 in. **Stroke**—3.75 in.

477

Now . . . 477 cubic inches of super power for your Extra Heavy Duty needs! Notice the high and flat torque curve (power curve at right) to insure maximum performance. Standard engine in Ford F-1000, C-1000 trucks. Optional T-850, T-950 tandem models.

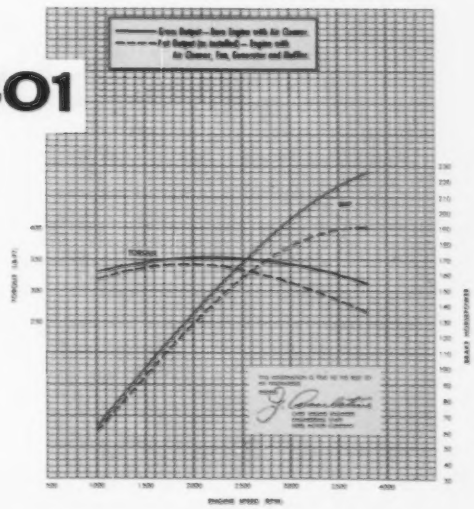




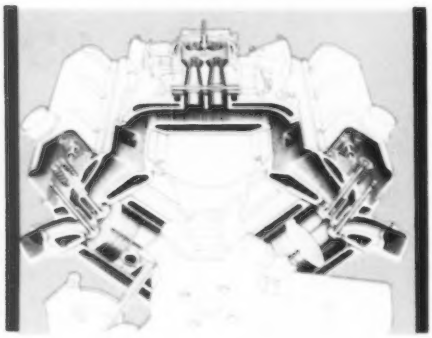
226-hp 401 SD V-8
Brake Horsepower—226 @ 3800 rpm
Torque—350 lbs-ft @ 1800-2300 rpm
Bore—4.12 in. **Stroke**—3.75 in.

401

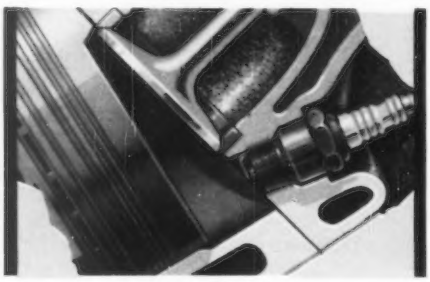
For higher earnings every trip, Ford Super Duty V-8's like this popular 401-cubic inch engine provide the best horsepower to weight ratios obtainable in comparable all-truck engines today. Standard in Ford F-, C- & T-850 and 950 models.



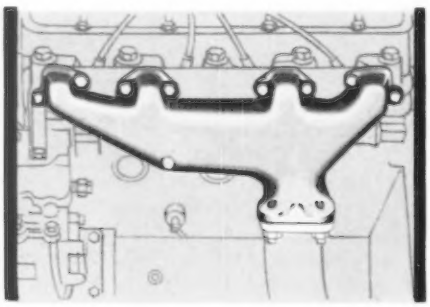
Outstanding new FORD V-8



NEW INTAKE MANIFOLDING—Much of the exceptional performance of Ford's new Super Duty V-8's can be traced to their free-breathing design. Thermostatically controlled carburetor air intake, Super-Filter air cleaner, 4-barrel carburetor, simplified intake manifold with water-jacketed passages and large intake valves—provide high intake efficiency. The modern single-bridge intake manifold distributes the fuel-air mixture more evenly for smoother performance. And its water-jacketed passages provide a more uniform fuel-air temperature.



MACHINED COMBUSTION CHAMBERS—New wedge-shape combustion chambers are fully machined for accurate volume and compression control. Completely in the block, there's less heat in the heads for improved valve cooling. The face of the head is flat-machined at 90° for positive mating with the block. The new wedge-shape chamber design together with Turbulence-Top piston heads gives better fuel-air turbulence for snappy power and minimized combustion deposits, and advanced "over square" (bore larger than stroke) Short Stroke engine design increases usable horsepower and torque . . . cuts internal friction for long engine life and greater fuel economy.



LOW BACK-PRESSURE EXHAUST MANIFOLDING—Improved exhaust manifolding reduces back pressure . . . means more usable power and longer engine life. For full performance, burned gases must be properly removed to make room for a fresh charge of fuel-air mixture. And on the new Ford Super Duty V-8 engines exhaust gases leave through large exhaust ports, down wide passages in the cylinder head to the generously sized exhaust manifolds and out dual exhaust pipes to complete the breathing cycle most efficiently.

DESIGN features

MODERN 3-STAGE PARALLEL FLOW COOLING

1. HEAD – For cold starts, both thermostats are closed and the coolant is pumped through the cylinder head and manifold water jacket, returning through a bypass to the pump. This restricted flow continues until the coolant reaches 140°. The rapid head warm-up preheats the fuel-air mixture for more efficient burning and greater power. Fast block warm-up also occurs, warming the oil for better lubrication.

2. HEAD AND BLOCK–At 140°, the back thermostat opens allowing coolant to circulate more rapidly through the block. The coolant flows through the head, block and intake manifold water jacket, but closed front thermostat prevents it from flowing through the radiator. It returns through a bypass to the water pump and is recirculated. This continues until the coolant in the intake manifold reaches 160°.

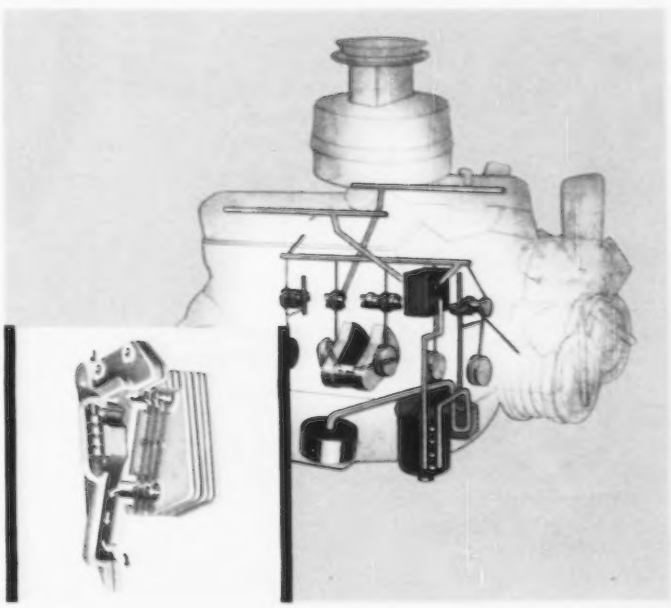
3. COMPLETE COOLING – At 160°, the front thermostat opens allowing the coolant to flow through the radiator and the entire cooling system. Approximately half of the coolant is directed to the heads and the other half to the block. This 3-stage system gives fast engine warm-up and effective cooling. Over ten thousand gallons of coolant per hour are pumped by the durable, high-capacity water pump.

NEW LUBRICATION SYSTEM

FULL-PRESSURE LUBRICATION SYSTEM – Oil is pumped under pressure through galleries in the block and head to the crankshaft main and connecting rod journals, camshaft journals, rocker shaft and arms, air compressor and timing gears. Valve stems, cam lobes, piston pins and valve lifters are effectively splash and gravity lubricated. Squirt holes in the connecting rods direct oil to cylinder walls.

Troublesome external oil lines have been virtually eliminated. And all oil is filtered passing through the large 2-quart Full-Flow oil filter.

INTERNAL OIL COOLING–A tremendous "plus" of the Ford lubrication system is the easily accessible internally mounted oil cooler. Standard equipment on all Super Duty V-8's, it's designed to keep the engine's oil at proper temperatures in extra-heavy-duty service. The oil cooler reduces oil temperatures to minimize carbonization . . . promotes greater oil film-strength . . . prolongs moving part life, main bearing, etc. . . . and extends time between oil changes.

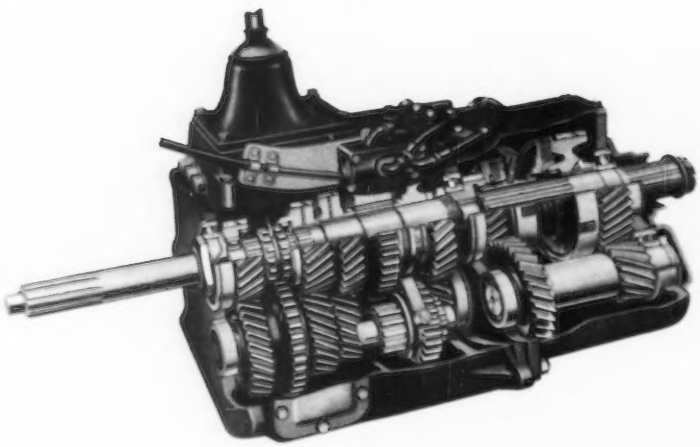


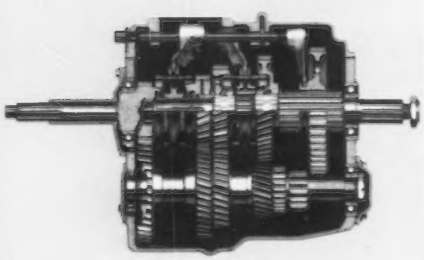
TWO-PLATE 13" CLUTCH — New, solid dual disc 13-inch clutch provides dependable, positive operation. Direct pressure is applied to the pressure plate by 12 coil springs. And the large facing area with two-plate design gives high torque capacity and long service.

For your extra-heavy-duty needs, Ford offers a wide selection of power train components designed for your individual requirements. Extra strength and capacity is engineered into each and every part to take the tremendous horsepower and torque output of the new Ford Super Duty engines . . . and to stand up under the big payloads Ford Extra Heavy Duty trucks are rated to haul. Transmissions, auxiliaries, clutches and Single- or Two-Speed rear axles are all engineered for outstanding performance and long, dependable service.

Extra strength in every

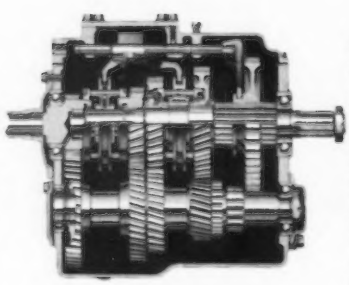
8-SPEED ROADRANGER — Designed for extra-heavy-duty over-the-road service, the Roadranger transmission provides 8 evenly spaced, progressive gear ratio steps. A four-speed constant mesh main gear box is coupled with an integrally mounted, synchronized Two-Speed reduction unit . . . giving 8 forward speeds to get loads under way faster and maintain highway speeds better. Shifting is powered by air, manually controlled by a convenient switch on the shift lever.





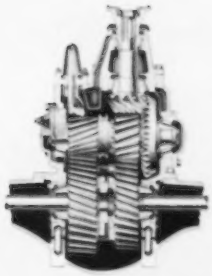
4000 SERIES SPICER TRANSMISSIONS

5-Speed Synchro-Silent, Direct-in-fifth transmissions are offered in a wide-ratio version, for use primarily with Single-Speed rear axles or with Two-Speed axles for off-the-road use. Close-ratio version for use with Two-Speed axles over-the-road.



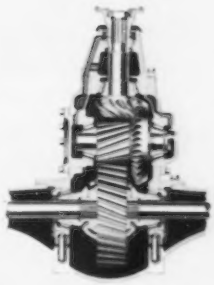
6000 SERIES SPICER TRANSMISSIONS

5-Speed Synchro-Silent, Direct-in-fifth or Overdrive-in-fifth (reduces engine revolutions about 17%) transmissions. Direct Drive is offered in both wide-ratio and close-ratio versions. Overdrive is close-ratio only.



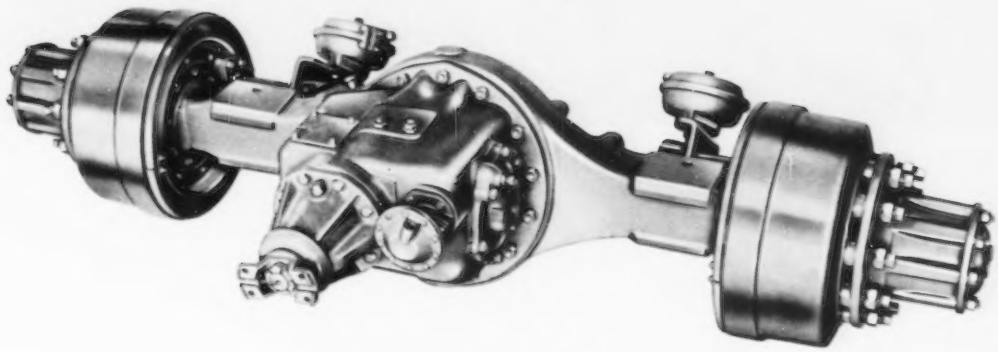
U-200

Rugged Single-Speed, double reduction, 29,000-lb. hypoid rear axle. Available with 6352 transmission on F- & C-1100 models. Not available on 99″ or 132″ wb. models.

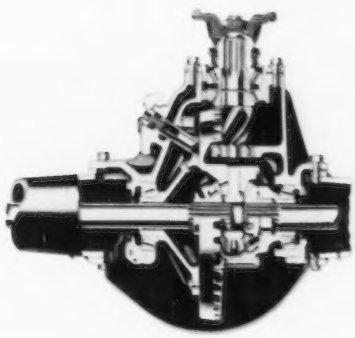


U-300

Big capacity Two-Speed, double reduction, 29,000-lb. hypoid rear axle. Available on F- & C-1100 models with 6352 transmission. Not available on 99″ or 132″ wb. models.

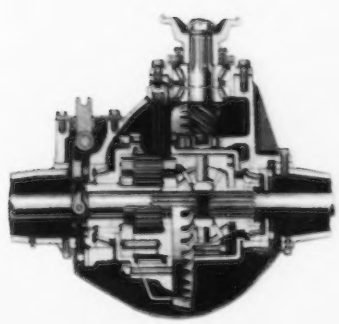


POWER TRAIN component



18,000-LB. SINGLE-SPEED
21,000-LB. SINGLE-SPEED
22,000-LB. SINGLE-SPEED

Spiral bevel, full-floating rear axle. Pinion is straddle-mounted for accurate alignment under high torque loads. All gears are alloy-steel, carburized and hardened for strength and wear resistance. And extra-capacity tapered-roller wheel bearings provide long, dependable service.

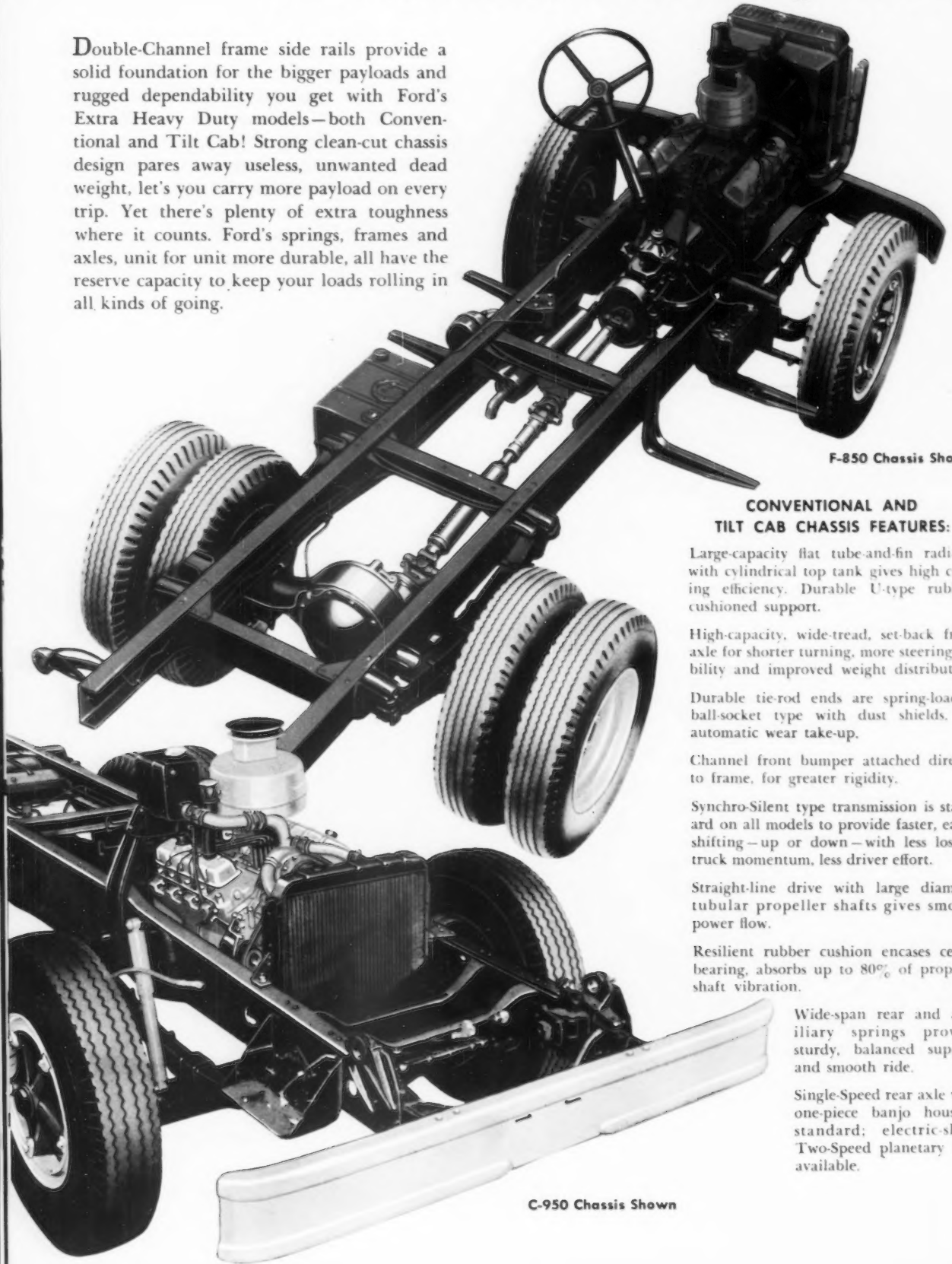


18,000-LB. TWO-SPEED
21,000-LB. TWO-SPEED
22,000-LB. TWO-SPEED

Spiral bevel, Two-Speed, full-floating rear axles. A planetary reduction gear set between the ring gear and differential provides two selective ratios for greater flexibility of truck operation. Easy to operate, positive-action, electric-shift control allows fast, easy shifting.

FORD Extra Heavy Duty

Double-Channel frame side rails provide a solid foundation for the bigger payloads and rugged dependability you get with Ford's Extra Heavy Duty models—both Conventional and Tilt Cab! Strong clean-cut chassis design pares away useless, unwanted dead weight, let's you carry more payload on every trip. Yet there's plenty of extra toughness where it counts. Ford's springs, frames and axles, unit for unit more durable, all have the reserve capacity to keep your loads rolling in all kinds of going.



F-850 Chassis Shown

C-950 Chassis Shown

CONVENTIONAL AND TILT CAB CHASSIS FEATURES:

Large-capacity flat tube-and-fin radiator with cylindrical top tank gives high cooling efficiency. Durable U-type rubber-cushioned support.

High-capacity, wide-tread, set-back front axle for shorter turning, more steering stability and improved weight distribution.

Durable tie-rod ends are spring-loaded, ball-socket type with dust shields, for automatic wear take-up.

Channel front bumper attached directly to frame, for greater rigidity.

Synchro-Silent type transmission is standard on all models to provide faster, easier shifting—up or down—with less loss of truck momentum, less driver effort.

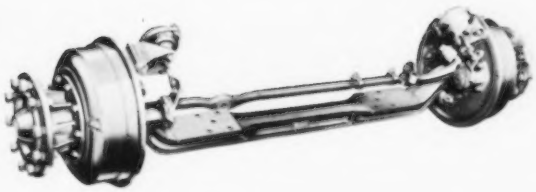
Straight-line drive with large diameter tubular propeller shafts gives smooth power flow.

Resilient rubber cushion encases center bearing, absorbs up to 80% of propeller shaft vibration.

Wide-span rear and auxiliary springs provide sturdy, balanced support and smooth ride.

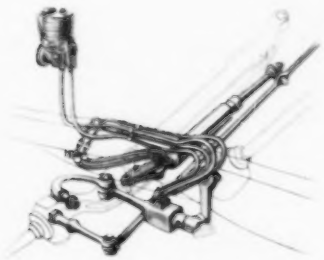
Single-Speed rear axle with one-piece banjo housing, standard; electric-shift, Two-Speed planetary type available.

chassis construction



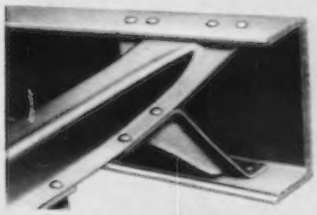
New Front Axles with modified I-beam construction, reinforced at stress points for extra durability. Available in 7000-, 9000-, 11000- and 15000-lb. capacities.

Roll-Action Steering with worm-and-roller type steering gear reduces friction, makes steering easier. Needle-bearing roller provides rolling rather than sliding action.

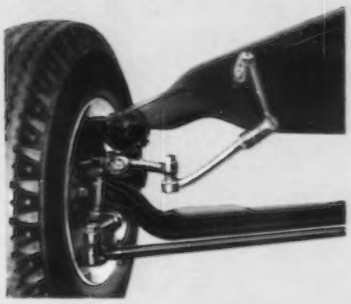


Master-Guide Power Steering is available on all F- and C-Series Extra Heavy Duty models . . . cuts steering effort as much as 75%.

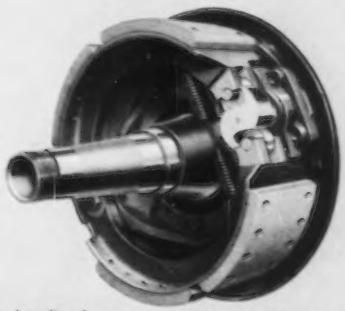
New Electric Fuel Pump mounted in fuel tank. Big capacity, submerged-type fuel pump delivers only liquid fuel—no vapor—under pressure from tank to carburetor. Not dependent on engine rpm's . . . provides ample fuel at any vehicle speed.



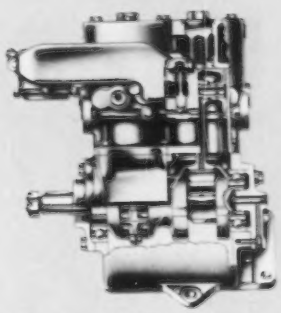
Double-Channel Frame Rails are engineered for extra strength and are highly resistant to twist and weave. Side rails have full channel reinforcement from front to rear springs.



Steering Linkage, solid Direct-Acting drag link, U-type steering arm and adjustable tie rod give excellent steering control and maneuverability.

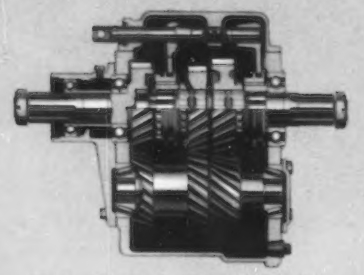


Full-Air Brakes are standard on F- and C-1000 and 1100 models, available 850 and 950. Compressor, two reservoir tanks, buzzer low-pressure indicator and air-operated windshield wipers included.

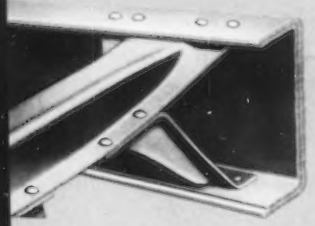


Big 12-cubic foot Air Compressor is available in place of standard 7¼-cu. ft. with full-air brakes on F- and C-950 thru 1100. Large 12-cubic foot per minute capacity provides extra safety factor.

FORD Tandem Chassis for

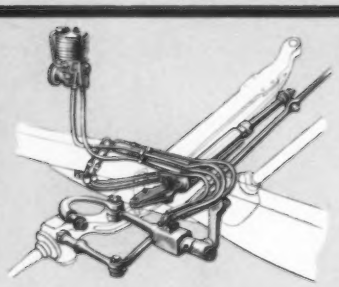


Two all-helical, 3-Speed Auxiliary constant mesh transmissions are available (except 144″ wb. T-850) for greater operating flexibility.



Double-Channel frame side rails for extra strength, lower weight. Channel-reinforced from front spring to end of frame.

Roadranger Transmission with 8 closely spaced forward speeds and preselect range shifting is optional for all models. Not offered with auxiliary transmission.



Master-Guide Power Steering standard . . . always operative, cuts steering effort up to 75%.

Large capacity flat-tube radiator with cylindrical top tank gives high cooling efficiency. Durable U-type support.

High-capacity, wide-tread, set-back front axle provides shorter turning, more stability, improved weight distribution.

Durable tie-rod ends are spring-loaded, ball-socket type with dust shields, for automatic wear take-up.

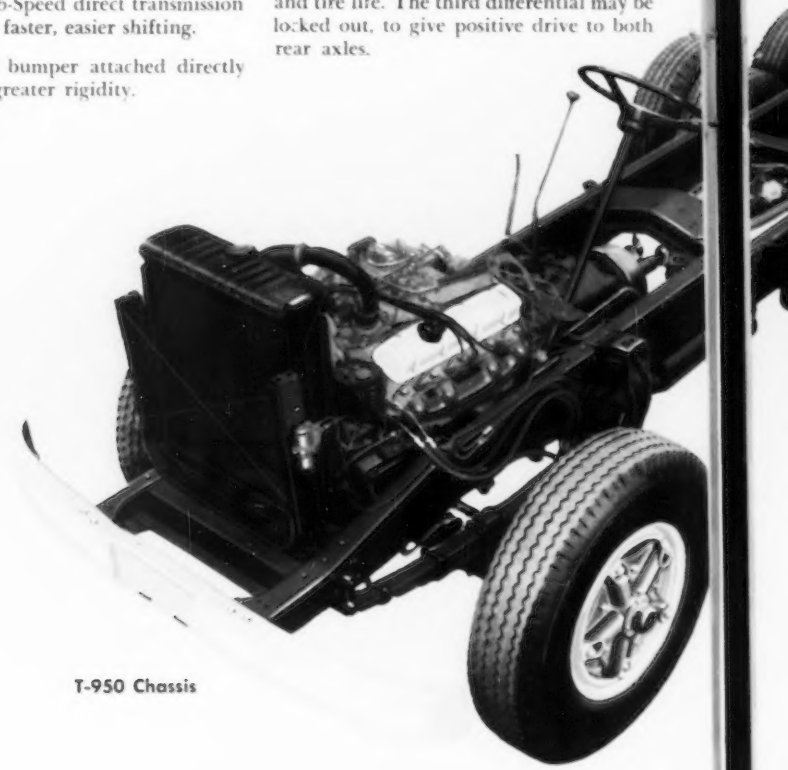
Synchro-Silent 5-Speed direct transmission is standard for faster, easier shifting.

Channel front bumper attached directly to frame, for greater rigidity.

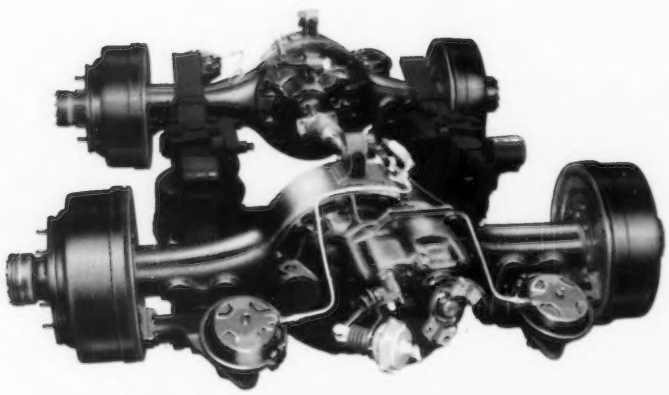
Tubular propeller shafts, large diameter, non-whipping. Long-lived needle-bearing joints. Rubber-encased drive line center bearing for longer life.

Torque arms absorb starting and stopping thrusts. Arms are rubber bushed at each end, and need no lubrication.

Power divider, provided with 3rd differential, equalizes the driving power between axles, eliminates axle fight for longer gear and tire life. The third differential may be locked out, to give positive drive to both rear axles.



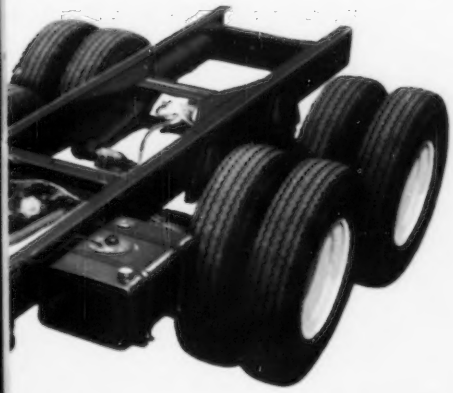
T-950 Chassis

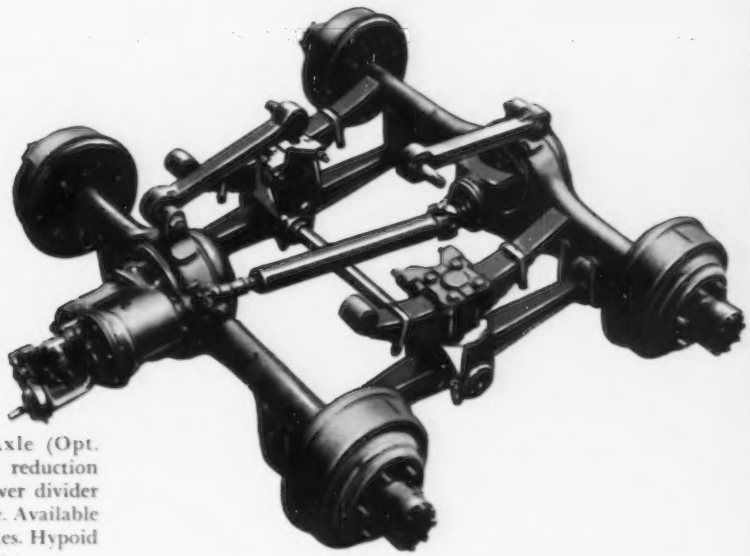


38D—38,000-lb. Tandem Axle (Std. T-950). Full-floating straight through drive axle with Single-Speed power divider on forward rear axle. Available with a choice of single reduction and planetary double reduction ratios. Equipped with full-air brakes.

extra payloads

More flotation is provided by eight rear tires . . . keeps truck from bogging down in mud, sand and other soft footing where single-rear-axle trucks would normally flounder. Walking-beam action levels bumps by 50%, minimizes "bounce."

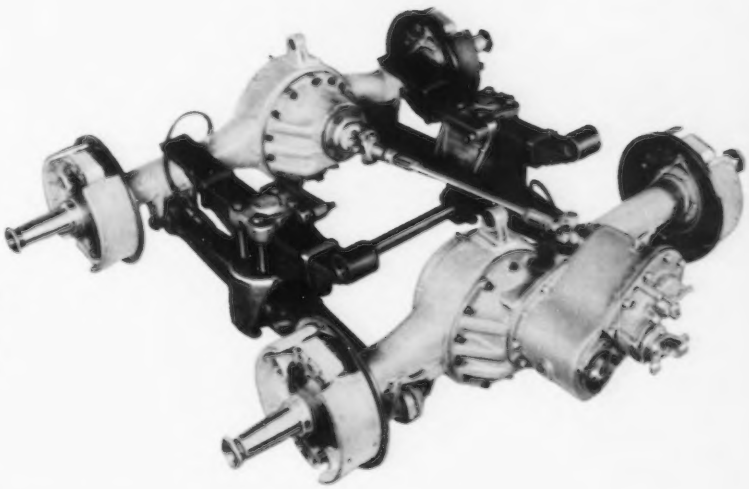




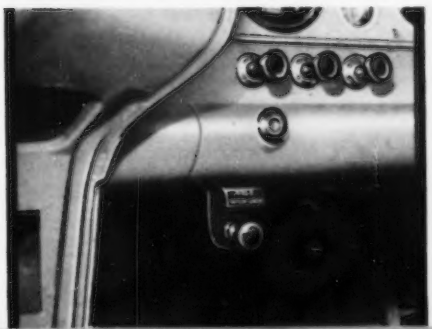
28M—28,000-lb. Tandem Axle (Opt. T-850). Full-floating, single reduction type with a Single-Speed power divider mounted on forward rear axle. Available with hydraulic or full-air brakes. Hypoid ring gear and pinion gear sets.

Two equalizing beams provide true axle alignment, distribute weight between axles. Rubber bushings do away with the need for lubrication.

Husky, short-coupled springs minimize side-sway, absorb road shocks, give smooth, level ride.



34M—34,000-lb. Tandem Axle (Std. T-850). Full-floating, single reduction type with a Single-Speed power divider mounted on forward rear axle. Available with hydraulic or full-air brakes. Spiral bevel ring gear and pinion gear sets.



Differential lockout control located on the instrument panel permits driver to lock out differential action giving each axle the same positive traction as if separately driven.

F-SERIES POWER TRAIN SELECTIONS

Engine—Transmission—Axle Ratio (to 1) Combinations

Transmission	F-850 with 401 SD V-8 Engine		F-950 with 401 SD V-8 Engine	
	18,000-lb. axle	18,000-lb. 2-Speed axle	21,000-lb. axle	21,000-lb. 2-Speed axle
4652	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
4756C	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6352	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
6852G	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6453A	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
R-46	6.50	—	6.50	—

Transmission	F-1000 with 477 SD V-8		F-1000 with 477 SD V-8 F-1100 with 534 SD V-8		F-1100 with 534 SD V-8	
	21,000-lb. axle	21,000-lb. 2-Speed axle	22,000-lb. axle	22,000-lb. 2-Speed axle	29,000-lb. axle	29,000-lb. 2-Speed axle
6352	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	7.03	6.42/8.38 or 7.09/9.07
6852G	—	6.50/8.87	—	6.14/8.36 or 6.71/9.13†	—	—
6453A	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	—	—
R-46	6.50	—	6.17 or 6.67	—	—	—

*Not recommended for tractor service.

†Not recommended for tractor service on F-1100 Series.

GVW 30,000 lb. • GCW 55,000 lb.

F-850 Specifications GVW 25,000 lb. • GCW 50,000 lb.

AXLE, FRONT
- Standard Axle Capacity—lb. 7,000
- Optional Axle Capacity—lb. 11,000
- Includes 5,000-lb. front springs. Requires air brakes, power steering and cast spoke or 10-hole disc wheels.

AXLE, REAR
- Capacity—lb. 18,000
- Standard—Type: Single Reduction—Spiral Bevel—Full-Floating
- Axle Ratios: 6.50 or 7.17 to 1
- Optional—Type: Two-Speed Planet—Full-Floating
- Ratios (to 1): 6.50/8.87 or 7.17/9.77*
- *7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
- Standard—Type: Vacuum-Power Operated, Hydraulic, Two-Shoe
- Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
- Front Brake (Drum Dia. x Lining Width—Thickness)—in.: 16 x 2¼—0.25
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in.: 16 x 5—0.50
- Total Area (Lining)—sq. in.: 488.6
- Booster (Effective Diaphragm Dia.)—in.: 10¼
- Optional—Type: Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thickness)—in.: 16 x 2½—0.312
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in.: 16½ x 6—0.75
- Total Area (Lining)—sq. in.: 579.3
- Compressor: 7¼ cu. ft. per min.
- Air Reservoir Tanks: Two—830-cu. in. Cap'y each

BRAKE, HAND
- Standard—Type: Drum and Contracting Band at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.): 10½ x 3—97.7
- Optional—Type (with 6000 Series and R-46 Transmissions): Internal Shoe
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.): 12 x 4—111.6

CLUTCH
- Type: Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in.: 378

COOLING SYSTEM
- Type—Capacity—qt.: Three-Stage—46
- Thermostats: Two, in Intake Manifold
- Fan, Diameter—in.: 21—5-Blade

DRIVE LINE
- Type: Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number: Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type: Three, Needle Roller Bearing
- Center Bearing: Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery: 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator: 50 Amp., 750 Watts
- Headlights: Dual Sealed-Beam, Foot-Switch Beam Control
- Starter: High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard: 226-hp 401 Super Duty V-8

FRAME
- Side Rails—Type: Parallel, Channel Section—Tapered Front and Rear
- Max. Section (Depth x Flange x Thick.)—in.: 9.5 x 3.0 x 0.25
- Reinforcement: Channel, Inside Side Rail
- Max. Section (Depth x Flange x Thick.)—in.: 9.0 x 2.56 x 0.15
- Section Modulus: 14.93
- Cross Members—Type: Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon: Frame-Mounted, Left Side
- Optional: 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side (Cylindrical not avail. on 132" wb.; Step Tanks require Air Brakes)

SPRINGS

	Front	Rear	
Semi-Elliptic, Ford Alloy Steel		Main	Auxiliary
Length x Width—in.	52 x 3	56 x 3	37.5 x 3
Number of Leaves	7	10	7
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	2500 lb.	7800 lb. (combined)	
Optional Spring Capacity	3000 lb.	8700 lb. (combined)	

STEERING
- Standard—Type: Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio: 20-in. Dia., 3-Spoke—20.5 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.2	49.5	52.8	58.0	62.7

- Optional—Type: Master-Guide Power Steering

TRANSMISSION
- Standard: Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional: 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
8-Speed Roadranger	(9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)					

- Power Take-Off Opening: SAE 6-Bolt, On Both Sides
- *Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type: Four—Cast Spoke
- Rims—Number—Size: Seven—22.5 x 6.75
- Tires—Number—Size: Six—10-22.5 10 PR

F-950 Specifications GVW 29,000 lb. • GCW 55,000 lb.

AXLE, FRONT
- Standard Axle Capacity—lb. 9,000
- Optional Axle Capacity—lb. 11,000
- Includes 5,000-lb. front springs. Requires air brakes, power steering.

AXLE, REAR
- Capacity—lb. 21,000
- Standard—Type: Single Reduction—Spiral Bevel—Full-Floating
- Axle Ratios: 6.50 or 7.17 to 1
- Optional Type: Two-Speed Planet—Full-Floating
- Ratios (to 1): 6.50/8.87 or 7.17/9.77*
- *7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
- Standard—Type: Vacuum-Power Operated, Hydraulic, Two-Shoe
- Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
- Front Brake (Drum Dia. x Lining Width—Thickness)—in.: 16 x 2¼—0.25
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in.: 16 x 6—0.50
- Total Area (Lining)—sq. in.: 556.2
- Booster (Effective Diaphragm Dia.)—in.: 9½
- Optional—Type: Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thickness)—in.: 16¼ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in.: 16½ x 6—0.75
- Total Area (Lining)—sq. in.: 650.0
- Compressor: 7¼ cu. ft. per min.
- Air Reservoir Tanks: Two—1,150-cu. in. Cap'y each
- Optional Compressor: 12 cu. ft. per min.

BRAKE, HAND
- Standard—Type: Drum and Contracting Band at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.): 10½ x 3—97.7
- Optional—Type (with 6000 Series and R-46 Transmissions): Internal Shoe
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.): 12 x 4—111.6

CLUTCH
- Type: Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in.: 378

COOLING SYSTEM
- Type—Capacity—qt.: Three-Stage—46
- Thermostats: Two, in Intake Manifold
- Fan, Diameter—in.: 21—5-Blade

DRIVE LINE
- Type: Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number: Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type: Three, Needle Roller Bearing
- Center Bearing: Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery: 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator: 50 Amp., 750 Watts
- Headlights: Dual Sealed-Beam, Foot-Switch Beam Control
- Starter: High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard: 226-hp 401 Super Duty V-8

FRAME
- Side Rails—Type: Parallel, Channel Section—Tapered Front and Rear
- Max. Section (Depth x Flange x Thick.)—in.: 9.75 x 3.50 x 0.28
- Reinforcement: Channel, Inside Side Rail
- Max. Section (Depth x Flange x Thick.)—in.: 9.20 x 3.03 x 0.25
- Section Modulus: 21.75
- Cross Members—Type: Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon: Frame-Mounted, Left Side
- Optional: 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side (Cylindrical not avail. on 132" wb.; Step Tanks require Air Brakes)

SPRINGS

	Front	Rear	
Semi-Elliptic, Ford Alloy Steel		Main	Auxiliary
Length x Width—in.	52 x 3	56 x 3	37.5 x 3
Number of Leaves	7	10	7
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	3000 lb.	9250 lb. (combined)	
Optional Spring Capacity	4000 lb.	10000 lb. (combined)	

STEERING
- Standard—Type: Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio: 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.1	49.4	52.7	57.9	62.6

- Optional—Type: Master-Guide Power Steering

TRANSMISSION
- Standard: Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional: 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger	(9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)					

- Power Take-Off Opening: SAE 6-Bolt, On Both Sides
- *Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type: Four—Cast Spoke
- Rims—Number—Size: Seven—22.5 x 7.5
- Tires—Number—Size: Six—11-22.5 12 PR

F-1000 Specifications

GVW 30,000 lb. • GCW 55,000 lb. (Opt. GCW 65,000 lb.*)

**Requires 22,000-lb. rear axle*

AXLE, FRONT
- Standard Axle Capacity—lb. ... 9,000
- Optional Axle Capacity—lb. ... 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. ... 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. ... 21,000
- Standard—Type ... Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios ... 6.50 or 7.17 to 1
- Optional—Type ... Two-Speed Planet—Full-Floating
  - Ratios (to 1) ... 6.50/8.87
- Optional Capacity—lb. ... 22,000
  - Type ... Single Reduction—Spiral Bevel—Full-Floating
    - Axle Ratios ... 6.17 or 6.67 to 1
  - Type ... Two-Speed Planet—Full-Floating
    - Ratios (to 1) ... 6.14/8.36 or 6.71/9.13

BRAKES, SERVICE
- Standard—Type ... Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thickness)—in. ... 16¼ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in. ... 16½ x 6—0.75
- Total Area (Lining)—sq. in. ... 650.0
- Compressor ... 7¼ cu. ft. per min.
- Air Reservoir Tanks ... Two—1,150-cu. in. Cap'y each
- Optional Brakes (w/9,000- or 11,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 718.2
- Optional Brakes (w/15,000-lb. Front and 21,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 664.6
- Optional Brakes (w/15,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 732.8
- Optional Compressor ... 12 cu. ft. per min.

BRAKE, HAND
- Type ... Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) ... 12 x 4—111.6

CLUTCH
- Type ... Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. ... 378

COOLING SYSTEM
- Type—Capacity—qt. ... Three-Stage—46
- Thermostats ... Two, in Intake Manifold
- Fan, Diameter—in. ... 21—5-Blade

DRIVE LINE
- Type ... Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number ... Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type ... Three, Needle Roller Bearing
- Center Bearing ... Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery ... 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator ... 50 Amp., 750 Watts
- Headlights ... Dual Sealed-Beam, Foot-Switch Beam Control
- Starter ... High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard ... 260-hp 477 Super Duty V-8

FRAME
- Side Rails—Type ... Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.75 x 3.50 x 0.28
- Reinforcement ... Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.20 x 3.03 x 0.25
- Section Modulus ... 21.75
- Cross Members—Type ... Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon ... Frame-Mounted, Left Side
- Optional ... 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side (Cylindrical not avail. on 132" wb.)

SPRINGS

	Front	Rear	
		Main	*Auxiliary*
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	52 x 3	56 x 3	37.5 x 3
Number of Leaves	7	10	9
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	3000 lb.	9650 lb. (combined)	
Optional Spring Capacity	4000 lb.	10400 lb. (combined)	

STEERING
- Standard—Type ... Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio ... 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.1	49.4	52.7	57.9	62.6

- Optional—Type ... Master-Guide Power Steering

TRANSMISSION
- Standard ... Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional ... 8-Speed R-46 Roadranger (6.17, 6.50 or 6.67 axle ratio required)

Gear Positions	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Reverse*
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening ... SAE 6-Bolt, On Both Sides

*Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type ... Four—Cast Spoke
- Rims—Number—Size ... Seven—22.5 x 7.5
- Tires—Number—Size ... Six—11-22.5 12 PR

F-1100 Specifications

GVW 30,000 lb. • GCW 65,000 lb. (Opt. GVW 36,000 lb.*)

**Requires 11,000-lb. front axle, 29,000-lb. rear axle, HD rear main springs and special frame*

AXLE, FRONT
- Standard Axle Capacity—lb. ... 9,000
- Optional Axle Capacity—lb. ... 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. ... 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. ... 22,000
- Standard—Type ... Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios ... 6.17 or 6.67 to 1
- Optional—Type ... Two-Speed Planet—Full-Floating
  - Ratios (to 1) ... 6.14/8.36 or 6.71/9.13*
- Optional Capacity—lb. ... 29,000**
  - Type ... Double Reduction—Hypoid, Helical—Full-Floating
    - Axle Ratios ... 7.03 to 1
  - Type ... Two-Speed Double Reduction—Full-Floating
    - Ratios (to 1) ... 6.42/8.38 or 7.09/9.07

*6.71/9.13 ratio not recommended for tractor service.
**With 6352 Transmission only. Not available with 132" wb.

BRAKES, SERVICE
- Standard—Type ... Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thick.)—in. ... 16¼ x 3½—0.312
- Rear Brake (Drum Dia. x Lining Width—Thick.)—in. ... 16½ x 7—0.75
- Total Area (Lining)—sq. in. ... 718.2
- Compressor ... 7¼ cu. ft. per min.
- Air Reservoir Tanks ... Two—1,150-cu. in. Cap'y each
- Optional Brakes (w/15,000-lb. Front and 22,000- or 29-000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 732.8
- Optional Compressor ... 12 cu. ft. per min.

BRAKE, HAND
- Type ... Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Diameter x Lining Width, in.—Lining Area, sq. in.) ... 12 x 4—111.6

CLUTCH
- Type ... Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. ... 378

COOLING SYSTEM
- Type—Capacity—qt. ... Three-Stage—47
- Thermostats ... Two, in Intake Manifold
- Fan, Diameter—in. ... 23—5-Blade

DRIVE LINE
- Type ... Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number ... Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type ... Three, Needle Roller Bearing
- Center Bearing ... Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery ... 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator ... 50 Amp., 750 Watts
- Headlights ... Dual Sealed-Beam, Foot-Switch Beam Control
- Starter ... High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard ... 277-hp 534 Super Duty V-8

FRAME
- Side Rails—Type ... Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.75 x 3.50 x 0.28
- Reinforcement ... Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.20 x 3.03 x 0.25
- Section Modulus ... 21.75
- Cross Members—Type ... Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon ... Frame-Mounted, Left Side
- Optional ... 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side (Cylindrical not avail. on 132" wb.)

SPRINGS

	Front	Rear	
		Main	*Auxiliary*
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	52 x 3	56 x 3	37.5 x 3
Number of Leaves	7	10	9
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	3000 lb.	9650 lb. (combined)	
Optional Spring Capacity	4000 lb.	10400 lb. (combined)	

STEERING
- Standard—Type ... Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio ... 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.1	49.4	52.7	57.9	62.6

- Optional—Type ... Master-Guide Power Steering

TRANSMISSION
- Standard ... Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional ... 8-Speed R-46 Roadranger (6.17 or 6.67 axle ratio required)

Gear Positions	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Reverse*
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening ... SAE 6-Bolt, On Both Sides

*Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type ... Four—Cast Spoke
- Rims—Number—Size ... Seven—22.5 x 7.5
- Tires—Number—Size ... Six—11-22.5 12 PR

C-SERIES POWER TRAIN SELECTIONS
Engine—Transmission—Axle Ratio (to 1) Combinations

	C-850 with 401 SD V-8 Engine		C-950 with 401 SD V-8 Engine	
Transmission	**18,000-lb. axle**	**18,000-lb. 2-Speed axle**	**21,000-lb. axle**	**21,000-lb. 2-Speed axle**
4652	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
4756C	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6352	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
6852G	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6453A	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
R-46	6.50	—	6.50	—

	C-1000 with 477 SD V-8		C-1000 with 477 SD V-8 C-1100 with 534 SD V-8		C-1100 with 534 SD V-8	
Transmission	**21,000-lb. axle**	**21,000-lb. 2-Speed axle**	**22,000-lb. axle**	**22,000-lb. 2-Speed axle**	**29,000-lb. axle**	**29,000-lb. 2-Speed axle**
6352	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	7.03	6.42/8.38 or 7.09/9.07
6852G	—	6.50/8.87	—	6.14/8.36 or 6.71/9.13†	—	—
6453A	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	—	—
R-46	6.50	—	6.17 or 6.67	—	—	—

*Not recommended for tractor service.

†Not recommended for tractor service on C-1100 Series.

C-850 Specifications GVW 26,000 lb. • GCW 50,000 lb.

AXLE, FRONT
- Standard Axle Capacity—lb. . . . 9,000
- Optional Axle Capacity—lb. . . . 11,000
  - Includes 5,000-lb. front springs. Requires air brakes, power steering and cast spoke or 10-hole disc wheels.

AXLE, REAR
- Capacity—lb. . . . 18,000
- Standard—Type . . . Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios . . . 6.50 or 7.17 to 1
- Optional—Type . . . Two-Speed Planet—Full-Floating
  - Ratios (to 1) . . . 6.50/8.87 or 7.17/9.77*
  - *7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
- Standard—Type . . . Vacuum-Power Operated, Hydraulic, Two-Shoe
  - Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
  - Front Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16 x 2¼—0.25
  - Rear Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16 x 5—0.50
  - Total Area (Lining)—sq. in. . . . 488.6
  - Booster (Effective Diaphragm Dia.)—in. . . . 10¼
- Optional—Type . . . Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
  - Front Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16 x 2½—0.312
  - Rear Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16½ x 6—0.75
  - Total Area (Lining)—sq. in. . . . 579.3
  - Compressor . . . 7¼ cu. ft. per. min.
  - Air Reservoir Tanks . . . Two—830-cu. in. Cap'y each

BRAKE, HAND
- Standard—Type . . . Drum and Contracting Band at Rear of Transmission on Drive Line
  - Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) . . . 10½ x 3—97.7
- Optional—Type (with 6000 Series and R-46 Transmissions) . . . Internal Shoe
  - Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) . . . 12 x 4—111.6

CLUTCH
- Type . . . Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. . . . 378

COOLING SYSTEM
- Type—Capacity—qt. . . . Three-Stage—51
- Thermostats . . . Two, in Intake Manifold
- Fan, Diameter—in. . . . 21—5-Blade

DRIVE LINE
- Type . . . Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number, Type (99" & 111" wb.) One, Tubular, Forged-Steel Ends
  (135" & 153" wb.) Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type (99" & 111" wb.) Two, Needle Roller Bearing
  (135" & 153" wb.) Three, Needle Roller Bearing
- Center Bearing . . . Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery . . . 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator . . . 50 Amp., 750 Watts
- Headlights . . . Dual Sealed-Beam, Foot-Switch Beam Control
- Starter . . . High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard . . . 226-hp 401 Super Duty V-8

FRAME
- Side Rails—Type . . . Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.5 x 3.0 x 0.25
- Reinforcement . . . Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.0 x 2.56 x 0.15
- Section Modulus . . . 14.93
- Cross Members—Type . . . Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon . . . Frame-Mounted, Left Side
- Optional . . . 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
- Standard—Type . . . Double-Acting, Telescopic

SPRINGS

	Front	Rear	
		Main	Auxiliary
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	57 x 3	56 x 3	37.5 x 3
Number of Leaves	9	10	7
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	4000 lb.	7800 lb.	(combined)
Optional Spring Capacity		8700 lb.	(combined)

STEERING
- Standard—Type . . . Worm and Dual Row Needle Bearing Roller

Wheel—Over-all Ratio . . . 20-in. Dia., 3-Spoke—24.4 to 1				
Wheelbase . . .	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.9	41.1	47.7	52.6

- Optional—Type . . . Master-Guide Power Steering

TRANSMISSION
- Standard . . . Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional . . . 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening . . . SAE 6-Bolt, On Both Sides
- *Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type . . . Four—Cast Spoke
- Rims—Number—Size . . . Seven—22.5 x 6.75
- Tires—Number—Size . . . Six—10-22.5 10 PR

C-950 Specifications GVW 30,000 lb. • GCW 55,000 lb.

AXLE, FRONT
- Standard Axle Capacity—lb. . . . 9,000
- Optional Axle Capacity—lb. . . . 11,000
  - Includes 5,000-lb. front springs. Requires air brakes, power steering.
- Optional Axle Capacity—lb. . . . 15,000
  - Includes 6,800-lb. front springs. Requires air brakes, power steering.

AXLE, REAR
- Capacity—lb. . . . 21,000
- Standard—Type . . . Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios . . . 6.50 or 7.17 to 1
- Optional—Type . . . Two-Speed Planet—Full-Floating
  - Ratios (to 1) . . . 6.50/8.87 or 7.17/9.77*
  - *7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
- Standard—Type . . . Vacuum-Power Operated, Hydraulic, Two-Shoe
  - Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
  - Front Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16 x 2¼—0.25
  - Rear Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16 x 6—0.50
  - Total Area (Lining)—sq. in. . . . 556.2
  - Booster (Effective Piston Dia.)—in. . . . 9½
- Optional—Type (w/9,000- or 11,000-lb. front axles) Full-Air, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
  - Front Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16½ x 3½—0.44
  - Rear Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16½ x 6—0.75
  - Total Area (Lining)—sq. in. . . . 650.0
  - Compressor . . . 7¼ cu. ft. per min.
  - Air Reservoir Tanks . . . Two—1,150-cu. in. Cap'y each
- Optional Compressor . . . 12 cu. ft. per min.
- Optional Full Air Brakes (w/15,000 front axle)
  - Front Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 17¼ x 3½—0.44
  - Rear Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16½ x 6—0.50
  - Total Area (Lining)—sq. in. . . . 664.6

BRAKE, HAND
- Standard—Type . . . Drum and Contracting Band at Rear of Transmission on Drive Line
  - Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) . . . 10½ x 3—97.7
- Optional—Type (with 6000 Series and R-46 Transmissions) . . . Internal Shoe
  - Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) . . . 12 x 4—111.6

CLUTCH
- Type . . . Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. . . . 378

COOLING SYSTEM
- Type—Capacity—qt. . . . Three-Stage—51
- Thermostats . . . Two, in Intake Manifold
- Fan, Diameter—in. . . . 21—5-Blade

DRIVE LINE
- Type . . . Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number, Type (99" & 111" wb.) One, Tubular, Forged-Steel Ends
  (135" & 153" wb.) Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type (99" & 111" wb.) Two, Needle Roller Bearing
  (135" & 153" wb.) Three, Needle Roller Bearing
- Center Bearing . . . Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery . . . 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator . . . 50 Amp., 750 Watts
- Headlights . . . Dual Sealed-Beam, Foot-Switch Beam Control
- Starter . . . High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard . . . 226-hp 401 Super Duty V-8

FRAME
- Side Rails—Type . . . Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.75 x 3.50 x 0.28
- Reinforcement . . . Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.20 x 3.03 x 0.25
- Section Modulus . . . 21.75
- Cross Members—Type . . . Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon . . . Frame-Mounted, Left Side
- Optional . . . 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
- Standard—Type . . . Double-Acting, Telescopic

SPRINGS

	Front	Rear	
		Main	Auxiliary
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	57 x 3	56 x 3	37.5 x 3
Number of Leaves	9	10	7
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	4000 lb.	9250 lb.	(combined)
Optional Spring Capacity		10000 lb.	(combined)

STEERING
- Standard—Type . . . Worm and Dual Row Needle Bearing Roller

Wheel—Over-all Ratio . . . 20-in. Dia., 3-Spoke—24.4 to 1				
Wheelbase . . .	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.9	41.2	47.8	52.7

- Optional—Type . . . Master-Guide Power Steering

TRANSMISSION
- Standard . . . Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional . . . 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening . . . SAE 6-Bolt, On Both Sides
- *Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type . . . Four—Cast Spoke
- Rims—Number—Size . . . Seven—22.5 x 7.5
- Tires—Number—Size . . . Six—11-22.5 12 PR

C-1000 Specifications

GVW 31,000 lb. • GCW 55,000 lb. (Opt. GCW 65,000 lb.*)

**Requires 22,000-lb. rear axle*

AXLE, FRONT
- Standard Axle Capacity—lb. . . . 9,000
- Optional Axle Capacity—lb. . . . 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. . . . 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. . . . 21,000
- Standard—Type . . . Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios . . . 6.50 or 7.17 to 1
- Optional—Type . . . Two-Speed Planet—Full-Floating
  - Ratios (to 1) . . . 6.50/8.85*
- Optional Capacity—lb. . . . 22,000
  - Type . . . Single Reduction—Spiral Bevel—Full-Floating
    - Axle Ratios . . . 6.17 or 6.67 to 1
  - Type . . . Two-Speed Planet—Full-Floating
    - Ratios (to 1) . . . 6.14/8.36 or 6.71/9.13

BRAKES, SERVICE
- Standard—Type . . . Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16½ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in. . . . 16½ x 6—0.75
- Total Area (Lining)—sq. in. . . . 650.0
- Compressor . . . 7¼ cu. ft. per min.
- Air Reservoir Tanks . . . Two—1,150-cu. in. Cap'y each
- Optional Brakes (w/9,000- or 11,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. . . . 718.2
- Optional Brakes (w/15,000-lb. Front and 21,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. . . . 664.6
- Optional Brakes (w/15,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. . . . 732.8
- Optional Compressor . . . 12 cu. ft. per min.

BRAKE, HAND
- Type . . . Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) . . . 12 x 4—111.6

CLUTCH
- Type . . . Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. . . . 378

COOLING SYSTEM
- Type—Capacity—qt. . . . Three-Stage—51
- Thermostats . . . Two, in Intake Manifold
- Fan, Diameter—in. . . . 21—5-Blade

DRIVE LINE
- Type . . . Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number, Type . . . (99" & 111" wb.) One, Tubular, Forged-Steel Ends (135" & 153" wb.) Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type . . . (99" & 111" wb.) Two, Needle Roller Bearing (135" & 153" wb.) Three, Needle Roller Bearing
- Center Bearing . . . Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery . . . 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator . . . 50 Amp., 750 Watts
- Headlights . . . Dual Sealed-Beam, Foot-Switch Beam Control
- Starter . . . High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard . . . 260-hp 477 Super Duty V-8

FRAME
- Side Rails—Type . . . Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.75 x 3.50 x 0.28
- Reinforcement . . . Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.20 x 3.03 x 0.25
- Section Modulus . . . 21.75
- Cross Members—Type . . . Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon . . . Frame-Mounted, Left Side
- Optional . . . 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
- Standard—Type . . . Double-Acting, Telescopic

SPRINGS

	Front	Rear		
		Main	Auxiliary
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	57 x 3	56 x 3	37.5 x 3
Number of Leaves	9	10	9
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	9650 lb. (combined)	
Optional Spring Capacity		10400 lb. (combined)	

STEERING
- Standard—Type . . . Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio . . . 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.7	41.0	47.6	52.5

- Optional—Type . . . Master-Guide Power Steering

TRANSMISSION
- Standard . . . Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional . . . 8-Speed R-46 Roadranger (6.17, 6.50 or 6.67 axle ratio required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger	(9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)					

- Power Take-Off Opening . . . SAE 6-Bolt, On Both Sides
- *Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type . . . Four—Cast Spoke
- Rims—Number—Size . . . Seven—22.5 x 7.5
- Tires—Number—Size . . . Six—11-22.5 12 PR

C-1100 Specifications

GVW 31,000 lb. • GCW 65,000 lb. (Opt. GVW 36,000 lb.*)

**Requires 11,000-lb. front axle, 29,000-lb. rear axle, HD rear main springs and special frame*

AXLE, FRONT
- Standard Axle Capacity—lb. . . . 9,000
- Optional Axle Capacity—lb. . . . 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. . . . 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. . . . 22,000
- Standard—Type . . . Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios . . . 6.17 or 6.67 to 1
- Optional—Type . . . Two-Speed Planet—Full-Floating
  - Ratios (to 1) . . . 6.14/8.36 or 6.71/9.13*
- Optional Capacity—lb. . . . 29,000**
  - Type . . . Double Reduction—Hypoid, Helical—Full-Floating
    - Axle Ratios . . . 7.03 to 1
  - Type . . . Two-Speed Double Reduction—Full-Floating
    - Ratios (to 1) . . . 6.42/8.38 or 7.09/9.07

*Not recommended for tractor service.
**With 6352 transmission only. Not available with 99" wb.

BRAKES, SERVICE
- Standard—Type . . . Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thick.)—in. . . . 16½ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thick.)—in. . . . 16½ x 7—0.75
- Total Area (Lining)—sq. in. . . . 718.2
- Compressor . . . 7¼ cu. ft. per min.
- Air Reservoir Tanks . . . Two—1,150-cu. in. Cap'y each
- Optional Brakes (w/15,000-lb. Front and 22,000-lb. or 29,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. . . . 732.8
- Optional Compressor . . . 12 cu. ft. per min.

BRAKE, HAND
- Type . . . Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) . . . 12 x 4—111.6

CLUTCH
- Type . . . Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. . . . 378

COOLING SYSTEM
- Type—Capacity—qt. . . . Three-Stage—52
- Thermostats . . . Two, in Intake Manifold
- Fan, Diameter—in. . . . 23—5-Blade

DRIVE LINE
- Type . . . Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number, Type . . . (99" & 111" wb.) One, Tubular, Forged-Steel Ends (135" & 153" wb.) Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type . . . (99" & 111" wb.) Two, Needle Roller Bearing (135" & 153" wb.) Three, Needle Roller Bearing
- Center Bearing . . . Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery . . . 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator . . . 50 Amp., 750 Watts
- Headlights . . . Dual Sealed-Beam, Foot-Switch Beam Control
- Starter . . . High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard . . . 277-hp Super Duty V-8

FRAME
- Side Rails—Type . . . Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.75 x 3.50 x 0.28
- Reinforcement . . . Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. . . . 9.20 x 3.03 x 0.25
- Section Modulus . . . 21.75
- Cross Members—Type . . . Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon . . . Frame-Mounted, Left Side
- Optional . . . 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
- Standard—Type . . . Double-Acting, Telescopic

SPRINGS

	Front	Rear		
		Main	Auxiliary
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	57 x 3	56 x 3	37.5 x 3
Number of Leaves	9	10	9
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	9650 lb. (combined)	
Optional Spring Capacity		10400 lb. (combined)	

STEERING
- Standard—Type . . . Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio . . . 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.8	41.1	47.8	52.8

- Optional—Type . . . Master-Guide Power Steering

TRANSMISSION
- Standard . . . Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional . . . Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional . . . 8-Speed R-46 Roadranger (6.17 or 6.67 axle ratio required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger	(9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)					

- Power Take-Off Opening . . . SAE 6-Bolt, On Both Sides
- *Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type . . . Four—Cast Spoke
- Rims—Number—Size . . . Seven—22.5 x 7.5
- Tires—Number—Size . . . Six—11-22.5 12 PR

T-SERIES POWER TRAIN SELECTIONS
Engine—Transmission—Axle Ratio (to 1) Combinations

T-850

Transmission	401 SD V-8		477 SD V-8	534 SD V-8
	28,000-lb. axle	34,000-lb. axle	34,000-lb. axle	34,000-lb. axle
4652 w/o Aux.	7.07 or 7.79	7.80 or 8.60	—	—
4652 w/7231B	7.07 or 7.79	7.80 or 8.60	—	—
4652 w/7231D	7.07 or 7.79	7.80 or 8.60	—	—
6352 w/o Aux.	7.07 or 7.79	7.80 or 8.60	6.69 or 7.80	5.85, 6.69 or 7.80
6352 w/7231B	7.07 or 7.79	7.80 or 8.60	6.69 or 7.80	5.85, 6.69 or 7.80
6352 w/7231D	7.07 or 7.79	7.80 or 8.60	6.69 or 7.80	—
R-46	7.07 or 7.79	6.69 or 7.80	5.85, 6.69 or 7.80	5.85, 6.69 or 7.80

T-950

Transmission	401 SD V-8	477 SD V-8	534 SD V-8
	38,000-lb. axle	38,000-lb. axle	38,000-lb. axle
4652 w/o Aux.	7.60 or 8.38	—	—
4652 w/7231B	7.60 or 8.38	—	—
4652 w/7231D	7.60 or 8.38	—	—
6352 w/o Aux.	7.60 or 8.38	6.50, 7.60 or 8.38	5.57, 6.50, 7.60 or 8.38
6352 w/7231B	7.60 or 8.38	6.50, 7.60 or 8.38	5.57, 6.50, 7.60 or 8.38
6352 w/7231D	7.60 or 8.38	6.50, 7.60 or 8.38	6.50, 7.60 or 8.38
R-46	7.60	6.50 or 7.60	5.57 or 6.50

T-850 Specifications

GVW 43,000 lb. • GCW 70,000 lb. (Opt. GVW 37,000* or 45,000† lb.)—(Opt. GCW 55,000 lb.*)

*Requires 28,000-lb. rear axle, 9,000-lb. front axle and 401 SD V-8
†Requires 34,000-lb. rear axle, 11,000-lb., or 15,000-lb. front axle, air brakes and maximum size wheels and tires

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000*
Includes 5,000-lb. front springs.
Optional Axle Capacity—lb. 15,000*
Includes 6,800-lb. front springs. *w/ 45,000-lb. GVW package only.

AXLE, REAR
Capacity—lb. 34,000
Type Single Reduction—Spiral Bevel—Full-Floating
Axle Ratios (w/401 V-8) 6.69,* 7.80 or 8.60 to 1
Optional Ratios (w/477 V-8) 5.85,* 6.69** or 7.80 to 1
(w/534 V-8) 5.85,* 6.69** or 7.80 to 1
*Available only with R-46 transmission and air brakes.
**Available only with air brakes.
Optional Capacity—lb. 28,000
Axle Ratios (w/401 V-8) 7.07 or 7.79 to 1
(includes 9-22.5 10 PR tires on 6.75 rims)

BRAKES, SERVICE
Standard—Type Vacuum-Power Operated, Hydraulic, Two-Shoe
Front Brake (Drum Dia. x Lining Width—Thick.)—in. 16 x 2¼—0.25
Rear Brake (Drum Dia. x Lining Width—Thick.)—in. 16 x 5—0.50
Total Area (Lining)—sq. in. 807.6
Booster (Effective Dia.)—in. 9.5
Optional Vacuum-Hydraulic Brakes (w/28,000-lb. Rear Axle)
Total Area (Lining)—sq. in. 765.6
Optional—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters.
Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Compressor 7¾ cu. ft. per min.
Air Reserve Tanks Three—830-cu. in. Cap'y each.
Optional Full-Air Brakes (w/9,000-lb. front and 28,000-lb. rear)
Total Area (Lining)—sq. in. 767.7
Optional—Full-Air Brakes (w/9,000- or 11,000-lb. front & 34,000-lb. rear)
Total Area (Lining)—sq. in. 904.7
Optional Full-Air Brakes (w/15,000-lb. front and 34,000-lb. rear axles)
Total Area (Lining)—sq. in. 1006.8
Optional Compressor 12 cu. ft. per min.

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmission on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 11½ x 4—142.7
Optional Type (with R-46, 6,000 and 7,000 Series Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—46 (47 with 534 SD V-8)
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21 (23 with 534 SD V-8)—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8
Optional 260-hp 477 Super Duty V-8†
Optional 277-hp 534 Super Duty V-8†
†Optional main transmission required.

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front, Full-Depth Rear
Max. Section (Depth x Flange x Thick.)—in. 9.75 x 3.50 x 0.375
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.00 x 3.125 x 0.15
Section Modulus 22.06
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks (except 144" wb.); 100-gal. Step Tanks, with air brakes only; 60-gal. Cylindrical Tank for Right and/or Left Side. (Cylindrical not avail. on 144" and 156" wb.)

SPRINGS

	Front	Rear
Semi-Elliptic, Ford Alloy Steel		
Length x Width—in.	52 x 3	34 x 4
Number of Leaves	8	12
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	15500 lb.

STEERING
Standard—Type Master-Guide Power Steering
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	49.4	52.7	58.0	62.6

TRANSMISSION

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
Standard 4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
Optional 6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
Optional R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01) (Axle ratios required: 5.85, 6.69, 7.80, 7.79 or 7.07. Not available with auxiliary transmission.)						

Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

TRANSMISSION, AUXILIARY (except 144" wb.)

Gear Positions	Overdrive	Underdrive	Direct
Ratios (to 1):			
Optional Spicer 7231B 3-Speed	0.86	1.24	1.00
Optional Spicer 7231D* 3-Speed	0.86	2.14	1.00

*Not available with 534 SD V-8.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Six—Cast Spoke
Rims—Number—Size Eleven—22.5 x 6.75
Tires—Number—Size Ten—10-22.5 10 PR

T-950 Specifications

GVW 46,000 lb. • GCW 75,000 lb. (Opt. GVW 48,000* or 51,000† lb.)

*Requires 11,000-lb. front axle
†Requires 15,000-lb. front axle

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000
Includes 5,000-lb. front springs.
Optional Axle Capacity—lb. 15,000
Includes 6,800-lb. front springs.

AXLE, REAR
Capacity—lb. 38,000
Type Single Speed—Spiral Bevel—Full-Floating
Axle Ratios (w/401 V-8) 7.60 or 8.38 to 1
Optional Ratios (w/477 V-8) 6.50, 7.60 or 8.38 to 1
(w/534 V-8) 5.57,* 6.50, 7.60 or 8.38 to 1
*Not used in combination w/7231D auxiliary transmission.

BRAKES, SERVICE
Standard—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters.
Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Front Brake (Drum Dia. x Lining Width—Thick.)—in. 16½ x 3½—0.312
Rear Brake (Drum Dia. x Lining Width—Thick.)—in. 16½ x 6—0.75
Total Area (Lining)—sq. in. 1061.8
Compressor 7¾ cu. ft. per min.
Air Reservoir Tanks One—1275-cu. in.; Two—1395-cu. in. Cap'y each
Optional Compressor 12 cu. ft. per min.
Optional Brakes—(w/15,000-lb. Front and 38,000-lb. Rear Axles)
Total Area (Lining)—sq. in. 1076.4

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmission on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 11½ x 4—142.7
Optional—Type (with R-46, 6,000 and 7,000 Series Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—46 (47 with 534 SD V-8)
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21 (23 with 534 SD V-8)—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8
Optional 260-hp 477 Super Duty V-8‡
Optional 277-hp 534 Super Duty V-8‡
‡Optional main transmission required.

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front, Full-Depth Rear
Max. Section (Depth x Flange x Thick.)—in. 9.95 x 3.50 x 0.375
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.20 x 3.125 x 0.25
Section Modulus 25.65
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side. (Cylindrical not avail. on 156" wb.)

SPRINGS

	Front	Rear
Semi-Elliptic, Ford Alloy Steel		
Length x Width—in.	52 x 3	34 x 4
Number of Leaves	8	12
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	15500 lb.

STEERING
Standard—Type Master-Guide Power Steering
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	52.7	57.9	62.6

TRANSMISSION

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
Standard 4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
Optional 6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
Optional R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01) (Axle ratios required: 7.60 w/401 V-8, 6.50 or 7.60 w/477 V-8 and 5.57 or 6.50 w/534 V-8. Not available with auxiliary transmission.)						

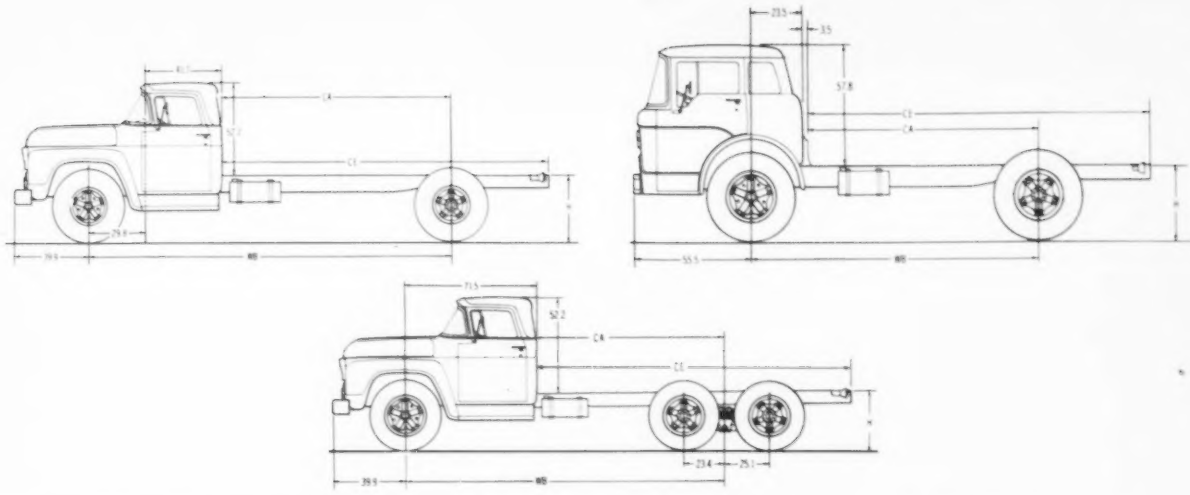
Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

TRANSMISSION, AUXILIARY

Gear Positions	Overdrive	Underdrive	Direct
Ratios (to 1):			
Optional Spicer 7231B 3-Speed	0.86	1.24	1.00
Optional Spicer 7231D* 3-Speed	0.86	2.14	1.00

*Not available in combination with 534 SD V-8 and 5.57 axle ratio.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Six—Cast Spoke
Rims—Number—Size Eleven—22.5 x 7.5
Tires—Number—Size Ten—11-22.5 12 PR



DIMENSIONS AND CHASSIS WEIGHTS

MODEL	WB (in.)	CA (in.)	CE (in.)	Nom. Body Lengths (ft.)	Curb Weights* (lb.) Front	Rear	Total
					10-22.5 10 PR Tires		
	132	60.5	111.7	7½-9	3995	2930	6925
F-850	144	72.5	123.7	9-11	4010	2950	6960
GVW 25,000 lb.	156	84.5	135.7	10-13	4035	3000	7035
	175	103.5	163.5	13-16	4065	3065	7130
	192	120.5	180.5	15-19	4175	3035	7210
					11-22.5 12 PR Tires		
F-950	132	60.5	111.7	7½-9	4285	3255	7540
GVW 29,000 lb.	144	72.5	123.7	9-11	4320	3285	7605
	156	84.5	135.7	10-13	4365	3335	7700
	175	103.5	163.5	13-16	4420	3390	7810
	192	120.5	180.5	15-19	4460	3425	7885
					11-22.5 12 PR Tires		
F-1000	132	60.5	111.7	7½-9	4340	3530	7870
GVW 30,000 lb.	144	72.5	123.7	9-11	4375	3565	7940
	156	84.5	135.7	10-13	4420	3610	8030
	175	103.5	163.5	13-16	4475	3665	8140
	192	120.5	180.5	15-19	4510	3700	8210
					11-22.5 12 PR Tires		
F-1100	132	60.5	111.7	7½-9	4345	3700	8045
GVW 30,000 lb.	144	72.5	123.7	9-11	4380	3735	8115
OPT. GVW 36,000 lb.	156	84.5	135.7	10-13	4425	3780	8205
	175	103.5	163.5	13-16	4480	3835	8315
	192	120.5	180.5	15-19	4520	3875	8395
					10-22.5 10 PR Tires		
C-850	99	72	123.2	9-11	5030	2335	7365
GVW 26,000 lb.	111	84	135.2	10-13	5040	2355	7395
	135	108	168.0	13-16	5135	2410	7545
	153	126	186.0	16-20	5175	2450	7625
					11-22.5 12 PR Tires		
C-950	99	72	123.2	9-11	5205	2775	7980
GVW 30,000 lb.	111	84	135.2	10-13	5225	2805	8030
	135	108	168.0	13-16	5320	2880	8200
	153	126	186.0	16-20	5375	2935	8310
					11-22.5 12 PR Tires		
C-1000	99	72	123.2	9-11	5465	3025	8490
GVW 31,000 lb.	111	84	135.2	10-13	5495	3050	8545
	135	108	168.0	13-16	5560	3095	8655
	153	126	186.0	16-20	5610	3125	8735
					11-22.5 12 PR Tires		
C-1100	99	72	123.2	9-11	5465	3195	8660
GVW 31,000 lb.	111	84	135.2	10-13	5495	3220	8715
OPT. GVW 36,000 lb.	135	108	168.0	13-16	5560	3265	8825
	153	126	186.0	16-20	5610	3295	8905
					10-22.5 10 PR Tires		
T-850	144	72.5	128.5	10-11	4100	6020	10120
GVW 43,000 lb.	156	84.5	144.5	11-13	4140	6055	10195
OPT. GVW 45,000 lb.	175	103.5	175.5	13-16	4210	6105	10315
OPT. GVW 37,000 lb.	192	120.5	204.5	15-19	4275	6155	10430
					11-22.5 12 PR Tires		
T-950							
GVW 46,000 lb.	156	84.5	144.5	11-13	4670	6735	11405
OPT. GVW 48,000 lb.	175	103.5	175.5	13-16	4795	6860	11655
OPT. GVW 51,000 lb.	192	120.5	204.5	15-19	4840	6905	11745

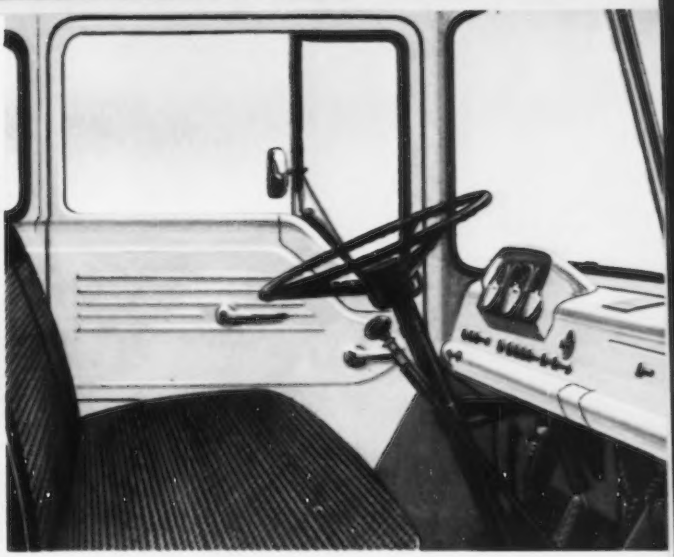
FRAME HEIGHT AT REAR AXLE

SERIES	TIRE SIZE	H (in.) Empty	Loaded
F-850	10-22.5 10 PR	36.0	33.0
	11-22.5 12 PR	36.6	33.6
F-950	11-22.5 12 PR	36.2	33.7
thru	11-24.5 12 PR	37.2	34.7
F-1100	12-22.5 12 or 14 PR	36.9	34.4
	12-24.5 12 PR	37.9	35.4
C-850	10-22.5 10 PR	35.1	32.9
	11-22.5 12 PR	35.7	33.5
C-950	11-22.5 12 PR	36.1	33.7
thru	11-24.5 12 PR	37.1	34.7
C-1100	12-22.5 12 or 14 PR	36.8	34.4
	12-24.5 12 PR	37.8	35.4
T-850	10-22.5 10 PR	38.7	37.7
	11-22.5 12 PR	39.3	38.3
T-950	11-22.5 12 PR	40.3	39.3
	11-24.5 12 PR	41.3	39.3
	12-22.5 12 or 14 PR	41.0	40.0
	12-24.5 12 PR	42.0	41.0

OPTIONAL EQUIPMENT ADD WEIGHTS

	Front	Rear	Total
Axle, Front—11,000 lb.			
F-850	110	0	110
F-950, F-1000, F-1100, T-850, T-950	90	0	90
C-850, C-950	115	0	115
C-1000	80	0	80
C-1100	105	0	105
Axle, Front—15,000 lb.			
F-1000, F-1100	280	0	280
C-950	250	0	250
C-1000	330	0	330
C-1100	360	0	360
T-850, T-950	380	0	380
Axle, Rear—Single-Speed			
F-C-1000—22,000 lb.	0	90	90
F-C-1100—29,000 lb.	0	225	225
Axle, Rear—Two-Speed			
F-C-850—18,000 lb.	0	125	125
F-C-950, F-C-1000—21,000 lb.	0	25	25
F-C-1000—22,000 lb.	0	150	150
F-C-1100—29,000 lb.	0	325	325
Axle, Rear—Tandem			
T-850—28,000 lb.	0	345†	345†
Brakes, Full Air			
F-850, C-850	95	205	300
F-950, C-950	90	165	255
T-850	120	405	525
Power Steering (F- & C-Series)	100	0	100
Transmission—6000 Series			
F-850, F-950	110	35	145
T-850	65	20	85
T-950	95	30	125
Transmission—Roadranger			
F-850, F-950	195	40	235
F-1000, F-1100	75	15	90
C-850, C-950	185	100	285
C-1000, C-1100	60	25	85
T-850 (over 4000 Series)	195	35	230
T-950 (over 4000 Series)	170	40	210
Tires, Tubeless			
F-C-850 11-22.5 12 PR (7.5)	66	140	206
F-C-950 thru 1100 11-24.5 12 PR (8.25)	58	134	192
12-22.5 12 PR (8.25)	46	103	149
12-24.5 12 PR (8.25)	76	170	246
12-22.5 14 PR (8.25)	68	147	215
T-850 11-22.5 12 PR (7.5)	66	273	339
T-950 11-24.5 12 PR (8.25)	58	250	308
12-22.5 12 PR (8.25)	46	195	241
12-24.5 12 PR (8.25)	76	322	398
12-22.5 14 PR (8.25)	68	272	340

*All weights are estimated. Curb weights include standard cab and equipment, full tank of fuel, oil and lubricants. For Chassis-Cowl deduct 395 lb. "Front," 175 lb. "Rear" and 570 lb. "Total." †Deduct.

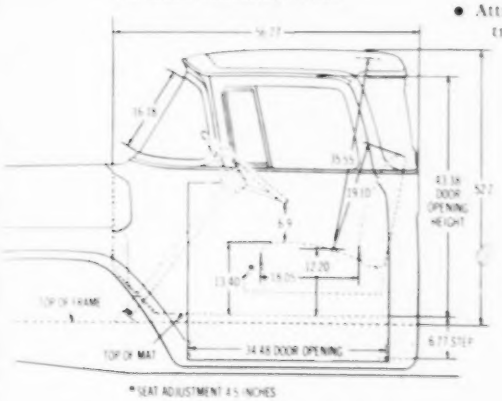


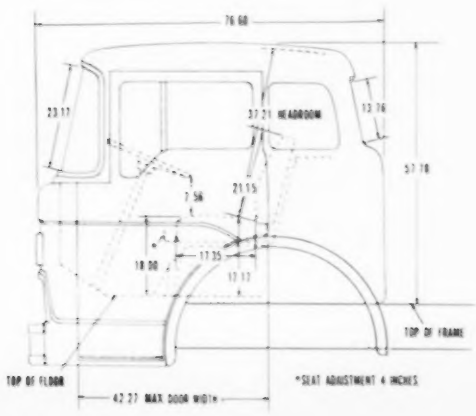
FORD Driverized Cabs

GREATEST CAB LUXURY AND VALUE—FORD'S CUSTOM CAB—

Conventional and Tilt (shown above) Add to Ford's standard cab features all these custom "extras," and you'll see why the Custom Cab is worth its small additional cost!

- Two-tone woven nylon-saran brown and white hound's-tooth pattern seat upholstery
- Foam-rubber padding in seat cushion
- Foam-rubber padding in seat back (driver's section, Tilt Cab)
- Thermacoustic headlining backed by one-half inch of glass wool insulation
- Sound deadener on floor and rear cab panel
- Insulation on cowl wall in cab (Conventional Cab)
- Attractive hardboard door and cowl-side trim panels (Conventional Cab)
- Arm rest on left door (Conventional Cab)
- Fold-down arm rest on driver's side (Tilt Cab)
- Large dome light with manual switch
- Sun visor on right side
- Illuminated cigar-cigarette lighter
- Bright-metal grille and hooded headlight assembly (Conventional Cab)
- Bright-metal windshield reveal molding
- Bright-metal parking light rims (Standard Tilt Cab)
- "Custom Cab" emblem on each door
- Matched locks on both doors





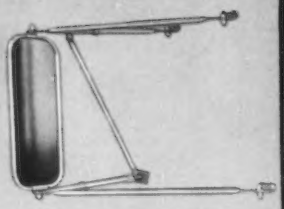
STANDARD CAB EQUIPMENT

(In addition to items listed on specification pages)

- Air Wing Ventilators in Doors
- Ammeter
- Ash Receptacle
- Cab All-Weather Ventilation (C-Series)
- Channel Front Bumper
- Choke Control
- Differential Lockout Control with Warning Light (T-Series)
- Dispatch Box
- Door Lock, Right Side
- Fuel Gauge
- Full-Wrap Windshield
- Hand Throttle
- Hi-Dri Cowl Ventilator (F- and T-Series)
- Horns, Twin Electric
- Inboard Cab Step
- Instrument Panel
- Light Switch
- Mirror, Rearview, Outside Left
- Oil Pressure Gauge
- Running Boards (F- and T-Series)
- Speedometer
- Sun Visor, Left Side
- Tachometer
- Tools
- Water Temperature Gauge
- Windshield Wipers, Dual Electric —Air on Air-Equipped Chassis

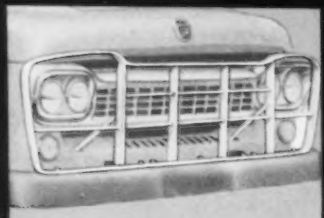
STANDARD COLORS

Choice of Vermilion, Midnight Blue, Azure Blue, Gunmetal Gray, Raven Black, Colonial White, Meadow Green, Seaspray Green, Goldenrod Yellow or Prime (F- and T-Series: on hood, fenders, cowl, cab, interior metal, inboard cab step, running boards and fuel filler cap. Any of the above colors can be combined with Colonial White for a smart Two Tone effect on the cab). (C-Series: on cab, interior metal, and inboard cab step.) Painted Raven Black are frame, door vent frame and glass channel, fuel tank, taillight, springs, axles, and wheels. Painted Colonial White are bumper, grille, dual headlight assembly, parking light rims and outside rearview mirror. Headlights and parking light rims are bright-metal on C-Series.

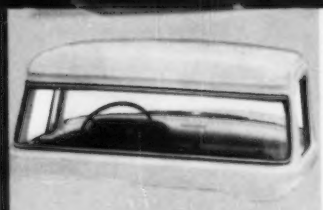


Full-view mirror (Western type) has a large 6 x 16 inch reflecting surface for maximum side and rear visibility. Adjustable arms and mirror.

Front-end power take-off for front-mounted pump, etc. Power take-off unit consisting of damper assembly and jack shaft available on Ford F- and T-Series.



Heavy-duty grille guard is braced to truck frame for grille, radiator and headlight protection. Rugged bar steel construction. Tow hooks also available.



Full-wrap rear window provides wide-angle visibility. Over 766 sq. in. available on F- & T-Series for Standard or Custom Cabs. Bright-metal molding around window.

FORD Accessories and Optional Equipment
in addition to those previously shown:

REGULAR PRODUCTION OPTIONS

Air Horns, on air equipped models
Arm Rest, Left (Standard Cab)
Cab, Custom
Carrier, Spare Wheel
Heater and Defroster, MagicAire or Recirculating
Hydraulic Jack, 5-ton (F- & C-850), 8-ton (F- & C-950, 1000 & 1100; T-850 & 950)
Padded Instrument Panel and Cushioned Visors
Radio
Spare Tire, Tubeless
Sun Visor, right side (Standard Cab)
Tinted Glass
Tube-Type Tires
Turn Signals, Front & Rear
Windshield Washers
Wheels & Tires (Tubeless)

F- & C-850

(7) 22.5 x 7.5 Rims
(7) 22.5 x 7.5 Disc Wheels, 8-hole or 10-hole type
(6) 11-22.5 12 PR Tires•

•Heavy Duty rear springs and 7.5 rims or wheels required.

F- & C-950, 1000 & 1100

(7) 22.5 x 8.25 Rims
(7) 24.5 x 8.25 Rims
(7) 22.5 x 7.5 Disc Wheels, 10-hole
(7) 22.5 x 8.25 Disc Wheels, 10-hole
(7) 24.5 x 8.25 Disc Wheels, 10-hole
(6) 11-24.5 12 PR Tires•
(6) 12-22.5 12 PR Tires•
(6) 12-24.5 12 PR Tires•
(6) 12-22.5 14 PR Tires•

•Heavy Duty rear springs and 8.25 rims or wheels required.

T-850

(11) 22.5 x 7.5• Rims
(11) 22.5 x 6.75•• Disc Wheels, 8-hole
(11) 22.5 x 7.5• Disc Wheels, 8-hole
(11) 22.5 x 7.5† Disc Wheels, 10-hole
(10) 10-22.5 10 PR Tires••
(10) 11-22.5 12 PR Tires•‡

•For highway operation only if used with 28,000-lb. axle.
••With 28,000-lb. axle only.
†With 34,000-lb. axle only.
‡22.5 x 7.5 rims or disc wheels required.

T-950

(11) 22.5 x 8.25 Rims
(11) 24.5 x 8.25 Rims
(11) 22.5 x 7.5 Disc Wheels, 10-hole
(11) 22.5 x 8.25 Disc Wheels, 10-hole
(11) 24.5 x 8.25 Disc Wheels, 10-hole
(10) 11-24.5 12 PR Tires•
(10) 12-22.5 12 PR Tires•
(10) 12-24.5 12 PR Tires•
(10) 12-22.5 14 PR Tires•

•8.25 rims or wheels required.

PRE-APPROVED OPTIONS

Arm Rest, Right Side for All Cabs
Cigar Lighter (Standard Cab)
Dome Light (Standard Cab)
Generator, Ford, 40 amp., 600 watts
Generator, 50 amp., 750 watt (T-850, T-950)
ICC Clearance Lights
Mirrors: Inside Safety;
Outside—Right, Non-Telescopic;
Left or Right, Telescopic (except C-Series)
Shock Absorbers, front (Std. on C-Series)
Spare Tire, Tube-type
Taillight, Right
Turn Signals, front only
Vacuum Reserve Tank, 1,000 cu. in. (F- & C-850, 950)

ACCESSORIES—DEALER INSTALLED

Fire Extinguisher
Locking Gas Tank Cap
Reflector Flares (3 in Kit) with Flags
Seat Belts
Seat Covers
Seat Cushion, Ventilated
Shaver, Electric
Splash Guards

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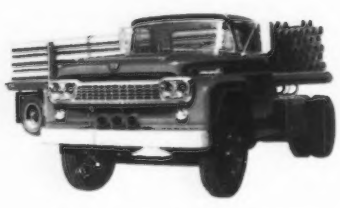
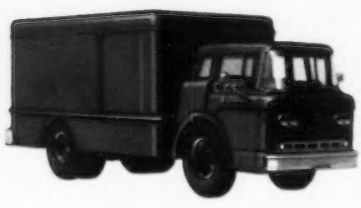
FORD Division of FORD MOTOR COMPANY • DEARBORN, MICHIGAN





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ENGINEERING AND MINING JOURNAL

FEBRUARY, 1958

1958—We've Been Here Before

SCANNING THROUGH this Annual Survey and Outlook issue one would certainly conclude that the most pressing problem confronting the mining industry is a temporary surplus of metals. But let's not get unduly alarmed by short-term developments. We've been through this cycle before, and have recovered to prosperous levels.

Here's a quote from a February 1954 editorial in *E&MJ* commenting on "The Crises of 1953":

"Looking ahead at 1953, we believed that it would be a year of crises, one in which decisions would be taken and events transpire that would affect the mining industry's activities for years to come.

"And so it has been. The world swung away from war toward peace. The pace of rearmament slackened. Consumers saw a shift from a sellers' to a buyers' market in most raw materials and in most finished articles.

"Some metals prices broke sharply. A new pricing basis for zinc was tried and abandoned. A flood of imports brought on a crisis for lead and zinc that is yet unresolved . . .

"Uncertainty plagued everyone through 1953. All one could be sure of was that 1954 would present new problems, no matter how the indices of industrial activity behaved."

In many respects, this previous editorial sums up the situation that we face today, and we'd like to believe that 1958 will see the same type of recovery in metal prices that took place in 1954. There is certainly enough strength and momentum in the domestic economy to warrant a good turn-about in the status of the mining industry. See p 109 for an introduction to the issue.

However this turn-about is not just going to happen. It can be helped along. For one thing both foreign and domestic producers are cutting back production, and in general have taken action that will trim back the stocks.

If post-war history repeats itself, this action should set the stage for the return of base metal prices to more favorable economic levels.

Acceleration of research and the development of new uses for nonferrous metals can also speed a recovery in demand. This concept, which was not generally accepted by many base-metal producers, is now gaining encouraging momentum. Industry organizations and individual metal companies have released an unprecedented volume of literature and information during 1957 aimed at selling more copper, lead and zinc as well as aluminum, magnesium, lithium, etc. Let's hope that this trend will continue to increase in 1958.

It would seem then that 1958 is the year in which to shift emphasis from production to sales.

On the technological front, progress is moving so fast that mining and mineral processing engineers are going to find it hard to keep pace with new developments, weigh their advantages and apply them. Regional mining meetings, general sessions of the AIME and the Mining Congress, technical magazines and international conferences in Sweden and Canada last year provided an unusually rich store of technical papers.

In the field of mineral processing alone, here are some of the subjects which have been presented, are being talked about, or hinted at: high-speed grinding, vibratory ball milling, high-arc smelting of manganese, flotation of beryllium minerals from pegmatites, electrostatic separation of iron ore, production of aluminum from clays, revival of the old segregation process for copper ores. See also review on mineral processing p 168, and progress in mining technology p 178.

To sum up then, 1958 should see improvement in the metal markets, particularly if we help the movement along by trimming output to match the world's appetite for metal and minerals, and preferably to stimulate that appetite with accelerated sales and new product development. In the mines and mineral processing plants, production staffs should find the coming "breathing spell" a welcome break during which to catch up on the wealth of new technical information being generated.

MARKETS

Copper Prices Drop Further; Output Cuts Announced. Other Metals Slow

JANUARY NONFERROUS METAL PRICES as measured by the *E&MJ* index dropped to 170.68% of the 1922-'24 average from 174.42 in December. The drop in copper was largely responsible. Silver was down a little.

Copper prices dropped further in January. Effective Monday, Jan. 13, Kennecott dropped its delivered price to 25c a lb in the U.S. The previous cuts had been initiated by Phelps Dodge. Other sellers dropped their prices on Jan. 13; Anaconda went to 25c Jan. 14. International Nickel and other Canadian companies dropped on the 13th to 24.75c Canadian currency delivered Toronto and comparable points. At the current exchange rate, this is equivalent to the U.S. 25c price. Custom smelters in the U.S. dropped to 24½c. Brass and bronze ingots dropped 1c. Copper products dropped 2c and brass products dropped according to their copper content.

London copper dropped about ½c to about 21.8c with the news of the U.S. price drop. About the same time the premium for specified shapes rose on the Continent from about £5 to about £7. It ended the month at 20½c. Late in January, U.S. custom smelters were selling at 24c and dealers were at about 23c. Katanga dropped to 21.55c Europe and the U.S. on the 23rd; at the beginning of the month it was 22.925c.

Sales of copper for delivery in the U.S. reported to *E&MJ* were almost unchanged from December; foreign sales were also almost unchanged. They totaled about 150,000 short tons.

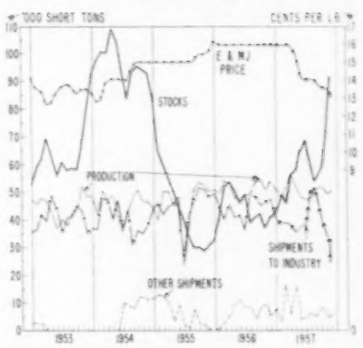
World refined copper stocks in December jumped 31,539 short tons to 458,340. This is probably the highest since the U.S. economic recession of 1938. In December, Free World mine production reported by the Copper Institute was at an annual rate of 2,952,000 short tons; the total for the year reported by the Copper Institute was 2,898,602 tons. This suggests that in spite of the considerable cuts in production announced by copper firms (see table in copper article) they have had little effect. Deliveries to fabricators in the U.S. dropped to 84,611; foreign deliveries were also down. Shipments, sales and orders of copper containing products by U.S. fabricators were low in December. Shipments for 1957 were 1,279,181 short tons, about 10% under 1955; 1956 was about equal to 1957. Sales in 1957 were 1,228,630 tons, down about 22% from 1955 and about 5% from 1956.

Production cuts were announced in January. Katanga let it be known it was cutting output, or had cut, by about 10%. The Chilean Copper Department recommended the two major producers reduce about 10% in Chile compared with 1956. Anaconda did so—this means a reduction of about 31,000 tons relative to 1956. Kennecott said it would reduce the sum of its shipments from the U.S. and Chile to Europe by more than 10% but would not reduce its Chilean output. It is assumed it will absorb the reduction through its cuts in U.S. output. Chile said this is satisfactory and suggested a company would cut its high cost output. Phelps Dodge said it would cut output another 9%, probably about 21,000 tons more. The Oppenheimer companies in Rhodesia said they would cut 27,000 tons annual rate in March, relative to what they had intended producing, by ceasing output at Bancroft. This mine had been scheduled to produce 40,000 tons annual rate. The firm said it would add 13,000 tons to output to two other mines. Most analysts say the firm's 1958 production would then be about 233,000 short tons; in 1956 it produced about 216,000 tons.

Tariffs on unfabricated copper are being demanded by some U.S. copper companies. A bill was proposed for a 4c import duty to be applied when the price in the U.S. is 30c. A considerable number of Congressmen are pressing for it. A 1.8c duty is suspended until July 1. It had been 2c but trade agreements arranged that it drop 5% each year; by July 1, when the suspension is to end, it will be down to 1.7c. If the *E&MJ Metal and Mineral Market* price drops to 24c delivered for a calendar month the duty must be reimposed. If a U.S. producer dropped to 24c the custom smelters would go below and the duty doubtless would come into effect.

Lead sales in the U. S. in January were very low and about equal to December. American Bureau of Metal Statistics for December show shipments to users were 24,108 tons, the lowest in years. Stocks jumped nearly 21,000 tons even though 5,658 tons were sent to non-consumers. London prompt lead ended the month at about 9¼c. At this price lead could be brought from the U.K. even and sold in the U.S. at almost 2c under the U.S. price. Sales of lead by U.S. producers near coastal points were scarce. The lack of sales reflects the belief by buyers that the price is not likely to rise. Some factors had expressed the hope that some changes in the U.S. Agriculture Department's barter program would lead to enough barter business to firm the lead market. But both Government spokesmen and officials of firms doing much barter have denied this would happen. GSA asked for lead tenders late in January.

Primary Refined Lead Data



Data, except price, from the American Bureau of Metal Statistics. "Other Shipments" refers to shipments to the U.S. Government. The price is the *E&MJ* weighted average, N. Y. Data through October. Price through December

Zinc sales reported to *E&MJ* for January are slightly better than December but still well under "normal." American Zinc Institute figures show December shipments down and stocks up by about 14,000 tons. Shipment data by grade for the past three years follow:

	1955	1956	1957
Sp. H.	402,629	343,350	338,155
H. G.	145,150	141,883	138,568
Inter.	23,543	24,770	20,235
P. W., etc.	524,787	524,524	462,171
Totals	1,114,109	1,034,527	959,129
To Govt.*	87,200	156,400	176,998

*Included in figures above.

London prices were about 7.8c to 8c most of the month. American Metal's Blackwell Zinc Co. in Oklahoma is cutting output 2,000 tpm; it will stock its Mexican ore output and will continue to produce from other Mexican ores. The Australian zinc firms, New Broken Hill and Zinc Corp., are reported to be stocking their zinc concentrates—this may mean over 100,000 tons annual rate withheld from the market. GSA asked for tenders late in January.

Aluminum markets continue slow. Alcoa announced it is stopping work on three expansion projects including the $80-million smelter at Warrick, Indiana and the primary facilities at Pt. Comfort, Tex. It said this decision was taken because the market is not taking its present output. Alcan said it would cut output in Canada by 60,000 tons annual rate—it said its inventory situation and near term demand did not justify full operation. Alcan asked the British Board of Trade to impose the anti-dumping import duty against USSR aluminum. A BBT memo said the latter was selling aluminum at £179, about 22½c per lb, apparently c.i.f. U.K. ports, more than £10 under Alcan and Alcoa. It suggested Alcan, by using the official ruble-sterling exchange rate, converted the Russian home price into the U.K. equivalent of £428. Dumping is selling in a foreign market at a price under the home market price or under the firm's cost. So this would mean extreme dumping. But some say this exchange rate is meaningless.

Tin prices in London rose about ¼c above the support level for prompt metal when the International Tin Council in effect decreased the allowable exports per month by the producing countries. The rate from December 15 through March 31 is about 40% under the earlier rate. The same reduced rate applies from April 1 to July 1.

Average Prices Jan. *(E&MJ Quotations)*

Copper:	
Electrolytic, domestic refinery	25.114
Electrolytic, export refinery	21.253
Lead:	
Common, New York 6	13.000
Common, St. Louis	12.800
Silver and sterling exchange:	
Silver, New York, per oz.	89.449
Silver, London, pence per oz.	76.847
Sterling Exchange	281.322
Zinc:	
Prime Western, East St. Louis	10.000
Prime, Western, delivered (g)	10.500
Tin:	
New York Straits	92.692
Gold per oz. U. S. price	$35.000
Quicksilver, per flash	$220.692
Antimony, (E&MJ) (d)	36.590
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$77.000
Cadmium (a)	155.000
Cadmium (b)	155.000
Cadmium (c)	155.000
Aluminum, 99% plus ingot	28.100
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Gold trading was up 9% in January. Bar gold purchases for U.S. investors were evident in Switzerland and in London. Coin prices declined by about 1½%. Latin American markets were active on coin troubles in Brazil, Chile and Peru. Indonesian coin trade soared on political unrest. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Dec. 31	Jan. 31	Dec. 31	Jan. 31
NEW YORK, transit	.....	.....	$35.08⅛	$35.08⅛
MANILA	$44.00	$43.25	36.60	36.50
HONG KONG	46.25	47.00	38.63	38.50
BOMBAY	58.00	57.50	57.00	57.00
TANGIER	42.50	42.55	34.96	35.00
BEIRUT	43.10	41.50	35.10	35.12
PARIS	43.00	41.50	36.15	36.13
BUENOS AIRES	39.15	38.50	36.30	35.90

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of January reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling commission.

Delivered Consumers' plants	24.500c lb
F.o.b. refinery	24.100c lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Jan. 1958	Electrolytic Copper (a) Domestic	(b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1				Holiday				
2	26.300	22.250	13.000	12.800	10.500	10.000	26.000	92.125
3	26.400	22.425	13.000	12.800	10.500	10.000	26.000	92.125
4	No Market	22.425	13.000	12.800	10.500	10.000	26.000	92.125
6	26.125	22.025	13.000	12.800	10.500	10.000	26.000	92.875
7	26.300	22.500	13.000	12.800	10.500	10.000	26.000	93.375
8	26.525	22.475	13.000	12.800	10.500	10.000	26.000	94.000
9	26.550	21.600	13.000	12.800	10.500	10.000	26.000	93.750
10	26.550	21.725	13.000	12.800	10.500	10.000	26.000	93.625
11	No Market	21.725	13.000	12.800	10.500	10.000	26.000	93.625
13	24.600	21.350	13.000	12.800	10.500	10.000	26.000	93.375
14	24.575	21.700	13.000	12.800	10.500	10.000	26.000	92.625
15	24.575	21.625	13.000	12.800	10.500	10.000	26.000	92.250
16	24.525	21.250	13.000	12.800	10.500	10.000	26.000	91.625
17	24.550	21.125	13.000	12.800	10.500	10.000	26.000	90.875
18	NotMarket	21.125	13.000	12.800	10.500	10.000	26.000	90.875
20	24.450	21.275	13.000	12.800	10.500	10.000	26.000	91.375
21	24.425	21.025	13.000	12.800	10.500	10.000	26.000	91.625
22	24.600	20.875	13.000	12.800	10.500	10.000	26.000	92.250
23	24.500	20.375	13.000	12.800	10.500	10.000	26.000	92.125
24	24.575	20.400	13.000	12.800	10.500	10.000	26.000	93.125
25	No Market	20.400	13.000	12.800	10.500	10.000	26.000	93.125
27	24.500	19.900	13.000	12.800	10.500	10.000	26.000	93.875
28	24.325	19.950	13.000	12.800	10.500	10.000	26.000	93.250
29	24.525	20.325	13.000	12.800	10.500	10.000	26.000	93.500
30	24.500	20.400	13.000	12.800	10.500	10.000	26.000	93.500
31	24.525	20.325	13.000	12.800	10.500	10.000	26.000	93.000
				AVERAGES FOR MONTH				
Jan.	25.114	21.253	13.000	12.800	10.500	10.000	26.000	92.692
				AVERAGES FOR WEEK				
Jan.								
1	26.494	22.250	13.000	12.800	10.500	10.000	26.000	92.425
8	26.330	22.350	13.000	12.800	10.500	10.000	26.000	92.771
15	25.370	21.621	13.000	12.800	10.500	10.000	26.000	93.208
22	24.510	21.113	13.000	12.800	10.500	10.000	26.000	91.438
29	24.485	20.225	13.000	12.800	10.500	10.000	26.000	93.167
				CALENDAR WEEK AVERAGES				
Jan.								
4	26.438	22.315	13.000	12.800	10.500	10.000	26.000	92.100
11	26.410	22.008	13.000	12.800	10.500	10.000	26.000	93.542
18	24.565	21.363	13.000	12.800	10.500	10.000	26.000	91.938
25	24.510	20.725	13.000	12.800	10.500	10.000	26.000	92.271

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Jan. 1958	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1			Holiday		
2	89.750	77.125d.	281.0625	249s. 2½d.	$35.00
3	89.875	77.125d.	281.0312	249s. ½d.	35.00
4	(e)	(e)	(e)	(e)	35.00
6	89.875	77.125d.	281.2187	249s. ½d.	35.00
7	89.875	77.125d.	280.9062	249s. ½d.	35.00
8	89.875	77.125d.	281.0312	249s. 0d.	35.00
9	89.875	77.125d.	281.0625	249s. ½d.	35.00
10	89.875	77.125d.	281.1562	248s. 11¾d.	35.00
11	(e)	(e)	(e)	(e)	35.00
13	89.875	77.125d.	281.3437	248s. 10¾d.	35.00
14	89.875	77.125d.	281.3750	248s. 8¾d.	35.00
15	89.625	77.125d.	281.2187	248s. 10d.	35.00
16	89.625	77.000d.	281.1562	249s. ¾d.	35.00
17	89.625	77.000d.	281.2968	248s. 11¾d.	35.00
18	(e)	(e)	(e)	(e)	35.00
20	89.625	77.000d.	281.4375	248s. 10¾d.	35.00
21	89.625	77.000d.	281.4687	248s. 9¼d.	35.00
22	89.625	77.000d.	281.5312	248s. 8¼d.	35.00
23	89.125	77.000d.	281.5312	248s. 8¼d.	35.00
24	89.125	76.500d.	281.5000	248s. 9d.	35.00
25	(e)	(e)	(e)	(e)	35.00
27	88.625	76.375d.	281.5312	248s. 9d.	35.00
28	88.625	76.125d.	281.5625	248s. 8¼d.	35.00
29	88.625	76.125d.	281.5312	248s. 9¼d.	35.00
30	88.625	76.125d.	281.5625	248s. 10¼d.	35.00
31	88.625	76.125d.	281.5625	249s. 2¼d.	35.00
			AVERAGES FOR MONTH		
Jan.	89.449	76.847d.	281.322	—	35.00
			AVERAGES FOR WEEK		
Jan.					
1	89.625	—	280.691	—	35.00
8	89.850	—	281.050	—	35.00
15	89.825	—	281.231	—	35.00
22	89.625	—	281.378	—	35.00
29	88.825	—	281.531	—	35.00

Calendar Week Averages: New York Silver: Jan. 4th, 89.719; 11th, 89.875; 18th, 89.725; 25th, 89.425.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(e) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Jan.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month	ZINC 3 Mo.	TIN Cash	TIN 3 Mo.
1	HOLIDAY											
2	179½	180½	183	183½	72	72¼	72	72½	61¼	61½	730	728½
3	178¼	178½	181¾	182	71¾	71½	71½	71¾	61½	61¾	730	728
6	179¼	179½	182½	182¾	71½	72	72	72¼	61¼	61¾	730	727½
7	178¾	179	182½	182¾	72¾	73	73	73¼	62¾	63	730	730
8	175¾	176	178¾	179	72	72¼	72¼	72½	62½	63	730	730½
9	175¾	176	179	179¼	72¼	72¾	72¾	72½	62⅞	63⅛	730	730½
10	175¾	176	178¾	179	72½	72¾	72¾	73	62¾	63	730	730½
13	177	177½	180	180½	73	73¼	73¼	73½	63½	63¾	730	730½
14	173¼	173½	176	176½	72½	72¾	72¾	73	62½	62¾	730	730½
15	173½	173¾	176	176¼	71¾	72	72¼	72½	61¾	62	730	730½
16	172¼	172⅝	174¾	175	70¾	71	71¼	71⅝	61¼	61½	730	730½
17	171¾	172	174¾	175	71¼	71½	71½	71⅝	61¼	61½	730	730½
20	171	171¼	173½	173¾	71¾	71⅞	72	72¼	61½	61¾	730	730½
21	169	169½	172	172¼	71¼	71½	71½	71¾	61¼	61½	730	730½
22	167½	167¾	170	170½	72¼	72½	73	73¼	63¼	63½	730	730½
23	165½	165¾	168	168¼	72¼	72½	72¾	72⅞	62½	62¾	730	730½
24	161½	161¾	163½	164	71½	71¾	72¼	72½	62½	62¾	730	730½
27	163	163½	165½	165¾	71½	71¾	72¼	72½	63	63¼	731½	732
28	163½	164	166	166¼	71¾	72	72½	72¾	63¼	63½	730½	731
29	163¾	164	165¾	166	72½	72¼	72⅞	73	63½	63¾	732½	733
30	167	167½	167¾	168	73¾	74¼	74	74½	64½	64¾	734½	735
31	163½	164	165½	165¾	73½	73½	73¾	73½	63¾	64	732½	733
Av'g's.	£171.369		£174.023		£72.168		£72.545		£62.568		£62.179	
											£730.773	£725.011

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98¾ and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton.

MISCELLANEOUS METALS

January 31, 1958

Aluminum ingot, 99 plus % lb.			28.1¢
Antimony, spot, lb. less than carload, in cases			36.59¢
In bulk, carload lots, f.o.b. Laredo			33.00¢
Bismuth, ton lots, lb.			$2.25
Cadmium, commercial sticks, delivered, lb.			$1.55
Calcium, lb. ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb. contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$2.00
Germanium, per gram, 10,000 gram lots	(c)38¢	@ (d)45½¢	
Indium, troy oz.			$2.25
Lithium, lb. 98%	$11.00	@	$14.00
Nickel, cathodes, lb (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.	70¢	@	75¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas, eff. Apr. 16			35½¢
Palladium, troy oz.	$19.00	@	$21.00
Platinum (wholesale lots), troy oz.	$75	@	$80
Quicksilver, flask of 76 lb., 25 flasks or more	$225	@	$230
Selenium, 99 plus %, lb—(No. 18, 1957)			$7.50
Silicon, minimum 97%, carloads, lb.			22¢
Semi-Conductor grade, lb.			$350
Tellurium, lb.			$1.65
Thallium, 100 lb. or more, lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb.			(b)$2.25

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective June 3, 1957.
(c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$37.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$26	@	$26.50
48% Cr_2O_3 3 to 1 ratio	$47	@	$57
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(e)
Mesabi bessemer			$11.60(e)
Mesabi, non-bessemer			$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton			$156.12
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included, $1.33 @ 1.36; both duties excluded, $1.195 @ $1.225. Long-term contract nominal.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18	@	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.15	@	$1.20
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$11	@	$12
U. S. scheelite, f.o.b. mill	$18.50	@	$19
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$56

(a) Nominal.
(e) Eff. 1957 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52	@	$1.55
Copper Sulphate, 100 lb eff. Jan. 13, '58			$10.70
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.38	@	$1.41
Imported, incl. 37¢ duty	$1.75	@	$2.05

ALLOYS

Ferrochrom 65 to 70%, per lb. of Cr. (4-9% C)			28¼¢
Ferromanganese, 74 to 76%, per lb., ship. pt.			12¼¢
Ferromolybdenum, 58 to 64% Mo, lb. of Mo contained	$1.68	@	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-19-57)			14.20
Ferrotungsten, 72 to 82%, lb. of W contained			$2.15
Ferrovandium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb., contracts			12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7			$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,470	@	$1,810
Crude No. 2	$788	@	$1,155
Spinning fibers	$353	@	$593
Shingle fibers	$190	@	$220
Paper stock	$120	@	$142
Waste	$82	@	$86
Shorts	$27	@	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1			$1,522
Spinning fibers	$494	@	$787
Shingle fibers	$142	@	$325
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$353	@	$383
Shingle stock	$172	@	$190
Paper stock	$114	@	$145
Waste, stucco or plaster			$82
Refuse or Shorts	$39	@	$72
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94% $BaSO_4$, per short ton	$16	@	$18
Crude oil well grade, min. 4.3 sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00	@	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00	@	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00	@	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.50
Glass feldspar, white, 20 mesh	$10	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@ Y	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)			$50.00
Some sellers quote			$55
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports			Not quoted
Sulphur, per lt, f.o.b. U. S. mines: bright			$23.50
dark	$22.50	@	$23
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	@	$31.60
For export f.o.b. vessel, lt, dep. on grade	$22	@	$24
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra fine			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$66.00
Steel, f.o.b. Pittsburgh, billets, net ton			$77.50
Structural shapes, Pa., Ala., etc, 100 lb	$5.10	@	$5.275

NEW OUTLETS TO BOOST MINE PRODUCTION

ALUMINUM

Aluminum-coated barbed wire, developed by U.S. Steel, has stood up under five years of field testing and is ready for the commercial stage.

Anodized aluminum driver's licenses, small enough to fit on a key chain, are issued to South Carolina's drivers. Information on larger filled-out forms is photographed and transferred to the small aluminum plates by a "Metalphoto" process.

BORON

Boron-10 which has the same shielding qualities as large amounts of lead or concrete is now being produced by Hooker Electrochemical Co. Value of boron-10 (B^{10}) is about $1,500 per lb.

LEAD

Howe Sound's Calera Mining Co. solved the corrosion problem in its 40-ft autoclaves treating highly corrosive cobalt-nickel solutions by lining the unit with 12-lb sheet lead. Former surface of 316-stainless didn't hold up. Lead Industries Assoc. Bulletin Vol. 21, No. 4.

MANGANESE

A new anti-knock compound containing manganese is reported by Ethyl Corp. to be the first potentially commercial anti-knock since the introduction of tetraethyl lead. Samples have been distributed for evaluation to several hundred oil and other companies here and abroad.

PERLITE

Demand for perlite as a soil conditioner and plant rooting and shipping material is increasing rapidly and a vast sales potential is indicated.

TITANIUM

A new titanium alloy sheet containing 4% aluminum, 3% molybdenum and 1% vanadium is now being produced by Titanium Metals Corp. of America. Special qualities are very high strength at ambient and elevated temperatures, and low density—0.163 lb/cu ft.

ZINC

An undercurrent of interest is growing in the possibility of using molten zinc as a media to refine metals differentially. Test work in the purification of spent reactor fuels indicates that zinc would be the best medium because of its low cost, availability, high purity, adequate volatility, and non-toxic nature. However, metallurgists say that aluminum also has possibilities.

URANIUM

First nuclear-powered cargo ship is scheduled to be launched in the Spring of 1959 at Camden, N.J. The 11,650-ton craft will be able to travel 300,000 miles without refueling, as compared with 13,000 miles for oil-fueled vessels. Nuclear power will come from uranium oxide filling 6,400 steel rods fitted into a 5½-ft dia cylinder, 90 in. high. The weight of lead, concrete, steel, plastic and wood shielding will limit the payload of the vessel to that of oil-fueled ships.

GENERAL

Weight-saving metals, even though very expensive, may be justified in plane construction. Magnesium Elektron, Ltd., of England estimates that the value of saving a pound of weight may range from £20 to nearly £100 per year on commercial aircraft depending on speed of the craft. For military craft where range and payload are critically important, even greater premiums can be paid to lighten construction.

Ultra-high purity alloys used in transistor parts and "doping materials" and solders include such combinations as gold-germanium, gold-antimony, gallium-antimony, gallium-aluminum, indium-zinc-gallium, silver-gallium-germanium, lead-arsenic, lead-gold-arsenic, and lead-silver-antimony.

Automobile manufacturers are working on two methods to reduce car combustion products: (1) Catalytic control of combustion to reduce CO, and (2) a pressure-meter feed control to give the engine only as much gas as it needs.

THIS MONTH IN MINING

Russia Releases Detailed Iron and Steel Data

THE FREE WORLD may get an important new perspective on Soviet Russia's economic and industrial potential as a result of the U. S. State Department's stepped-up East-West information exchange program.

The first of a series of Kremlin studies on its natural resources reserves and raw material development plans already has been translated by the U. S. Bureau of Mines, and there is a prospect of more to come.

Covering iron ore reserves and iron and steel production, the first report comes from a 560-page book by Ivan P. Bardin, vice chairman of the Soviet Academy of Sciences and a leading ferrous metallurgist. Together with other technical articles and statistical surveys, it was transcribed into a review by Alexander Gakner, East European specialist of the Bureau's foreign activities division.

The highlights of the report are:

- Total Russian reserves of iron ore of all types are now estimated at 57.7-billion metric tons, second in size only to the U. S. and 25% of world reserves.
- Moscow figures to nearly triple its 1955 production of steel (45.3-million metric tons) by 1970.
- Although Soviet industry is still centered in the European sector, its biggest untapped sources of iron and other metals and minerals lie in Asia, and the government plans to gradually shift mining and processing plants to the east, as part of a general industrial decentralization.
- Despite its huge reserves of iron, ore content is steadily declining, and increasingly lower grades of ore must be relied upon—a problem similar to that faced by the U. S. iron industry. Further, of the reserve total, only 13-billion metric tons is measured, 20-billion metric tons indicated—the rest is inferred.
- Shortages of ferrous scrap, the high cost of transportation, and difficulty of supplying an adequate labor force in remote eastern sectors will slow the Kremlin's industrial shift to Asia.
- Newer techniques of mining and processing, such as direct reduction of lower-grade fuels, electric and low-shaft furnaces, sonic and thermal drilling methods, are being tried and accepted—probably more readily than in the U. S.

Gakner and division chief Elmer W. Pehrson regard the report as a "unique and sober analysis," more detailed and accurate than any information previously available out of Russia.

Two factors make the initial report stand out and give promise of more and better information from Moscow in the future. One is that the Kremlin itself is apparently making a real effort to find out more about its own raw material supply and production potential. A special committee of scientists and technicians under the ministry of geology and conservation of natural resources has been assigned the job of making a five-year study of Russian metal-mineral reserves and helping to guide future development.

The other is that Moscow seems to be willing to let the results of its studies be known in the Free World, particularly when on balance the report is favorable. To publicize its material strengths, in other words, the Soviet is more willing and able to provide better and franker critiques of its own situation. The corollary of this, U. S. officials caution, is that Moscow will probably say nothing when its studies show an unfavorable position relative to any particular material or industry, particularly in the field of nonferrous metals.

Bardin, in turn, has visited the U. S., and discussed comparisons between U. S. and Soviet metals and minerals industries with Bureau of Mines officials. Impressed with Bardin's scholarly frankness, Bureau people say they have learned much about Russian mining and that both nations can benefit from the exchange without endangering national security. Bardin and Pehrson agree that the U. S. and Russia each has its special areas of advancement in mining, but from an overall view the two countries compare favorably with each other in technology and natural resources.

Prior to the improved information exchange program, Gakner wrote in commenting on an earlier general report from Moscow on Russian resources that "the claims made by the Soviet Union in this report must be taken at something less than face value."

These claims included the generalization that "at present the Soviet Union is first in the world in explored reserves of iron and manganese ores, copper, lead, zinc, nickel, bauxite, tungsten, mercury, sulphur, potash salt, phosphate raw material, as well as in total reserves of coal, peat and forest resources."

The iron ore and steel production study, in contrast to broad generalizations of more political than scientific use, is thorough and candid. Some of its significant findings are:

Average iron content of ores mined in Russia dropped from 54.6% in 1940 to 47.4% in 1955, with direct shipping grades accounting for 82 and 58% of total ores mined for the same two years.

By 1970, however, the Soviet plans an output of 208.5-million metric tons of prepared iron ore, 95-million metric tons of pig iron, and 120-million metric tons of crude steel, representing nearly three-fold increases over current figures. Emphasizing the shift to the east, only 5.8% of total crude iron ore output was in Asia in 1955, 25.9% is planned by 1970.

Exports of usable iron ores, all from the European sector, will increase to 16.7-million metric tons by 1960, up from an estimated 10.7-million metric tons last year.

In anticipation of "a growing scrap shortage" Russia plans to boost its ratio of pig iron to steel output in the year 1970.

Large Precious Metal Firms Consolidate

CONSOLIDATION of nine American companies in the precious metals and precision-manufacturing field to form Engelhard Industries, Inc. was announced by Charles W. Engelhard, New Jersey industrialist, early in January. New corporation, with annual sales in excess of $200-million, is the world's largest fabricator of precious metals.

Gordon V. Richdale, financial associate of Engelhard and former South African gold mining executive, is president of the new corporation. Mr. Engelhard is chairman of the board.

Largest firm in the consolidation is Baker & Co., Inc., refiner and fabricator of platinum. The company grossed $53-million in 1957. Other consolidated firms include Hanovia Chemical & Manufacturing Co., producers of liquid precious metals for the ceramics industry; American Platinum Works, refiners and workers of silver; Amersil Co., manufacturers of fused quartz; Irvington Smelting & Refining Works; D. E. Makepeace Co., producers of atomic reactor parts and precious metal materials; National Electric Instrument Co., makers of medical and industrial instruments; and H. A. Wilson Co., producers of electrical contacts and special alloys.

Precious metals, jewelry, precision instruments and metal catalysts valued at $890,000 were on exhibit at the Waldorf-Astoria hotel in New York to show scope of products made by the new corporation. The company does not make consumer products. The exhibit included platinum catalysts now used to make nearly all of the world's nitric acid and low-cost high-octane petroleum products.

Despite the important part that catalysts play in major industrial processes, scientists still do not understand exactly how they work, according to a research

director of Engelhard Industries who explained exhibits. He said that a single reforming unit in the petroleum field required thousands of ounces of platinum in the catalytic platforms.

Engelhard is building a new $1-million research laboratory in Newark, N. J., and has just completed a $1-million plant at Plainville, Mass., for the manufacture of atomic-reactor components. The first license issued by the U. S. Atomic Energy Commission for the reprocessing of cold enriched uranium went to Engelhard. Nuclear Corp. of America, Inc., a company subsidiary, is researching the pilot-plant production of purified rare earths to satisfy the growing demands for the products by industry and the military services.

Engelhard and Richdale are chairman and director, respectively, of Rand American Investments, Ltd., which controls a $400-million mining and manufacturing empire in South Africa.

Richdale stressed the international character of the new corporation which has plants in Italy, Switzerland, Great Britain, South America, Canada and Australia; and maintains sales offices throughout the Free World.

Mining Calendar

AIME annual meeting. Hotel Statler and Sheraton-McAlpin, N.Y. February 16-20

1958 Nuclear Congress. International Amphitheatre, Chicago, Ill., March 17-21

18th Annual Meeting, American Congress on Surveying & Mapping. Shoreham Hotel, Washington D.C. March 23-26

24th Annual Meeting, American Society of Photogrammetry. Shoreham Hotel, Washington D.C. March 26-29

Pacific Southwest Conference, AIME. St. Francis Hotel, San Francisco, March 27-29

American Chemical Society, 133rd National Meeting. San Francisco, April

Pacific Northwest Regional Conference, AIME, Spokane, Wash. April 17-19

3rd Annual Mining, Mineral, and Petroleum Conference of Alaska Section. U. of Alaska, April 18-20

Canada-United States Conference On Chemical Engineering. Montreal, April 20-23

North Texas Section, AIME, 3rd Bienniel Secondary Recovery Symposium. Wichita Falls, Kan., May 5-6

3rd Annual Uranium Symposium, Uranium Section, AIME, Moab, Utah, May 9-11

3rd Reactive Metals Conference, Niagara Frontier Section, AIME, Statler Hotel, Buffalo, N.Y., May 27-29

Rocky Mountain Minerals Conference, AIME, Salt Lake City, Sept. 10-12

13th Purdue Industrial Waste Conference & Exhibit. Convention Hall, Philadelphia, Pa., Sept. 15-19

(Continued on page 211)

As We Went to Press . . .

Hanna Coal & Ore Corp. has taken an option to buy a substantial interest in St. John d'el Rey Mining Co., Minas Gerais, Brazil, from Leo Model, of New York.

St. John, in which Model is the controlling shareholder and in which Hanna has had an interest for some time, is a British company engaged in Brazilian gold mining operations, and has land holdings believed to contain large tonnages of iron ore.

Pacific Northwest Alloys Co. is negotiating with GSA to purchase the electrometals plant at Mead, Wash., which it has been leasing from the Government since 1948.

Plant was built in 1943 at a cost of about $20-million to provide magnesium production in World War II. Purchase price is expected to be about $3-million.

"An advance, not a breakthrough" was one way scientists described the recent British announcement that a few stray neutrons of undetermined origin had been sighted in experiments conducted in the ZETA reactor at Harwell. British scientists produced temperatures as high as 5-million deg C, and held this fantastic heat for from 2 to 5 thousandths of a second without melting down the container. British are not positive that fusion occurred, but they have good reason to believe that it did.

Problems confronting commercial, controlled thermonuclear power are immense—to raise the temperature to the 400-million deg C where fusion could occur using deuterium, tritium or lithium as the fuel source; to be able to maintain that temperature long enough for a self-sustaining reaction to develop; to be able to contain the reaction within a reactor; and to extract useable power.

Fusion's advantages are that no radioactivity is developed, and that we have an unlimited supply of fuel in the seas. When will it come? No one can be sure, but most feel that it will be at least 20 years; maybe more. Is fusion a danger to uranium? See p 123.

Bethlehem Steel Co.'s Lackawanna, N.Y. plant reached a new level in 1957 with iron ore receipts totaling 6,030,000 net tons compared to last year's 5,425,000, general manager John E. Jacobs announced.

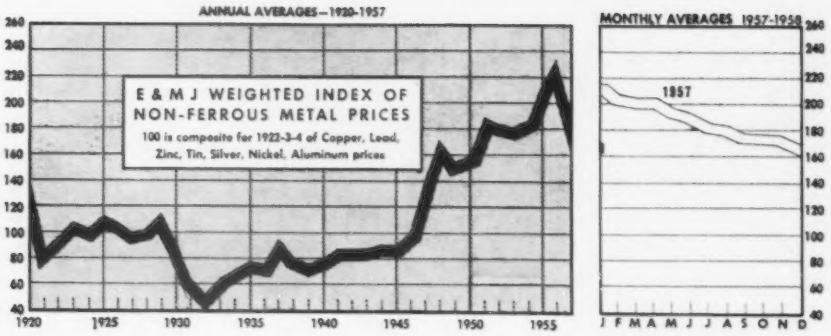
Sometime in February, Anaconda Co. expects to start the first test runs in their 50-tpd alumina-from-clay pilot plant at Anaconda, Mont. About 10,000 tons of Idaho clay will be processed to collect the data needed for the design of a commercial unit that Anaconda says will supply all their alumina needs.

Mining interests on Capitol Hill say they don't expect to confirm the appointment of Royce Hardy as minerals assistant secretary of Interior until the Department comes up with revised plans for aiding such domestically depressed industries as copper, lead, zinc and tungsten.

Consolidated Coppermines Corp. has sold its holdings in Nevada's White Pine County (Tripp pit, water rights, surface buildings, equipment, etc.) to the Kennecott Copper Corp. for $8.4-million.

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1957
E & M J WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum prices
MONTHLY AVERAGES 1957-1958
1957
J F M A M J J A S O N D

MARKETS

E&MJ's metal price index dropped from 174.42 in December to 170.91 for January. Lower copper prices and a drop in silver accounted for the decrease.

AT HOME

U.S. Industrial Chemicals Co. started construction on a new tantalum-columbium pilot plant at Cincinnati, Ohio. Capacity will be one ton of combined metals per month.

Alan Wood's $3.5-million direct-reduction powdered iron plant has moved up scheduled completion from 1959 to 1958.

Perlite Institute estimates that 1957 sales of the expanded product held firm during 1957 with a volume of $13.2-million. Production of crude was 307,000 tons with estimated value of $2.5-million. Perlite Institute now has members in Canada, Mexico, Venezuela, Germany, Great Britain, Greece, Japan, Australia and New Zealand.

Eighteen mining organizations are using radioisotopes in research work, according to a report by Atomic Industrial Forum. Seven were added to the list in 1957.

LABOR

International Union of Mine, Mill and Smelter Workers reports that 10,000 workers in all sectors of the non-ferrous metals industry have lost their jobs during the past eight months. In a mild sponsorship of tariffs on copper, lead and zinc the International Executive Board seems to be having some difficulty in reconciling the interests of U.S. workers who want tariffs, and Canadian workers who do not.

ABROAD

Alcoa and the Government of Surinam have signed an agreement for a $150-million aluminum smelter and hydro-electric project. The power project will consist of a dam on the Surinam River, power house, and 150,000-kw transmission line. Construction will start by 1960. Capacity of the smelter will be 60,000 tons of aluminum per year.

Pressure for tariffs and import curbs by American industry is stirring up threats of retaliation in Canada and Latin America. Although mild at present, these could become worrisome for international mining companies.

Cuban American Nickel Co., Freeport Sulphur subsidiary, will build a plant to produce 60 tons of liquid hydrogen sulphide per day to process cobalt-nickel ores from the Moa Bay operations. Production is slated to start in mid-1959.

Indicated copper reserves of the world were calculated to be of the order of 190-million tons of recoverable copper—or enough to supply the world for 60 years at the present rate of consumption, according to Sir Ronald Prain who reported recent estimates of the International Geological Congress in a lecture at the University of London.

"CAP SCREW"
(TYPE-CS)
CONNECTORS
BY

Ohio Brass

MANSFIELD OHIO, U.S.A.

FOR COPPER CABLE
TEE CONNECTORS

500,000 cm	22564
750,000 cm	22565
1,000,000 cm	22566

STRAIGHT-THRU CONNECTORS

4/0	22486
350,000 cm	22487
500,000 cm	22488
750,000 cm	22489
1,000,000 cm	22490

CONNECTOR PLATE
Catalog No. 22551

4823-M

Your Key To Better

THE NEW National Mine

National Mine Service Company

The simplicity and effectiveness of the single prime mover principle for shuttle cars is again proving itself in the new National Mine Diesel TorKars—just as it has in the A.C. and D.C. models of this advanced design of car.

Initially developed and built by one of the nation's largest mining companies, with years of experience, the TorKar was constructed to eliminate the weaknesses found in conventional shuttle cars. The new car so far exceeded expectations in five years of exhaustive testing and actual operation that it was decided to make it available to the mining industry through selection of National Mine as the exclusive manufacturer and distributor.

With excellent facilities and technical assistance, National Mine has further developed the TorKar and produced several different models based on the principle of a single prime mover driving through a torque converter. Now, for the first time, diesel TorKars have been introduced; and already they are establishing new standards for performance and maintenance.

The single-stage torque converter cushions and reduces peak loads and shock, protecting both the engine and transmission from excessive wear and reducing maintenance. The three-speed transmission permits the operator to select a gear suitable for the type of grade and roadway. Consequently, engine power is more fully employed and there is no need for overpowering, with all the attendant factors which increase cost of operation and maintenance—and may even affect ventilation.

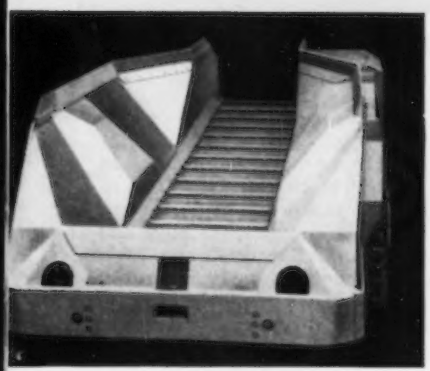
Among the many plus features of the diesel TorKar are a patented National Mine exhaust gas conditioner which has been used very successfully on various types of diesel-powered underground mining machinery; convenient controls; four-wheel drive and steering; new type interchangeable, heavy-duty spur gear-and-pinion wheel units; abrasive-resistant liners in the hopper and conveyor bed; solid flights; and rugged frame and body.

The design of the diesel TorKar gives it great flexibility, and models are available with tractive characteristics and overall dimensions suitable for almost any mine operating conditions. For full details on these remarkably efficient new diesel shuttle cars, write, or consult your National Mine representative.

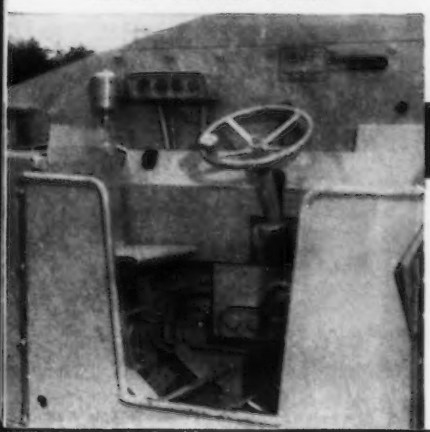
*trademark

Mine Haulage....

DIESEL TORKAR*



60" car has 253 cubic feet capacity—sideboards can be added. *(below)* Controls are conveniently grouped. Clutch lock has "deadman" control.



Approval No. 2414, U.S. Bureau of Mines, Schedule 24.

Specifications

Capacity: 15 to 18 ton

Length: 24'6"

Width: 111½" overall; body 96"

Wheelbase: 102"

Height: 60" without sideboards

Weight: 34,000 lbs.

Tires: 14.00 x 24, 20 ply

Engine: Optional

Fuel Tank: 60 gal. capacity

Speed: Loaded car on level—low 2.2 mph; second 3.6 mph; high 5.2 mph.

Transmission: Constant mesh, three speeds forward and reverse

Drive: Torque converter

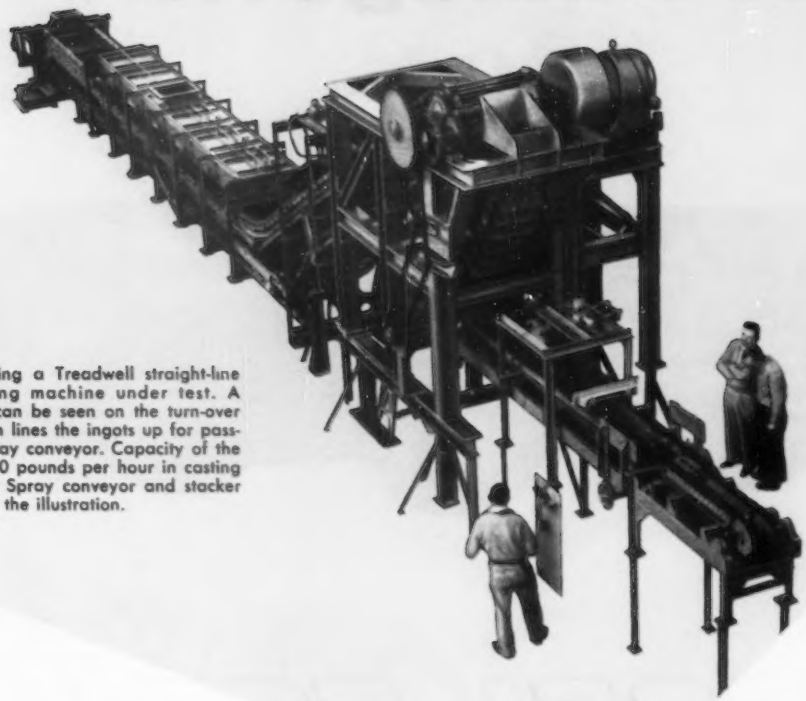
Steering: Hydraulic power

Exhaust: Patented National Mine exhaust gas conditioner

National Mine Service Company

564 Alcoa Building • Pittsburgh, Pennsylvania

Canada: Mine Equipment Company Limited, Montreal, Quebec
South Africa: Dowson & Dobson Ltd., Johannesburg
Australia: Noyes Bros. Pty. Limited, Sydney



Shop view showing a Treadwell straight-line aluminum casting machine under test. A 50-pound ingot can be seen on the turn-over mechanism, which lines the ingots up for passing on to the spray conveyor. Capacity of the machine is 25,000 pounds per hour in casting 50-pound ingots. Spray conveyor and stacker are not shown in the illustration.

Now you can have straight-line aluminum casting — fully automated from pouring to stacking

Treadwell straight-line aluminum-casting machines are built for high-speed, low-cost production. You save on labor because of the many integrated, automatic features. Among these are a ladle tilting mechanism, a mechanical stamping device, a spray conveyor and an ingenious stacking machine.

In operation, the ingots are poured, stamped, cooled and conveyed to the stacking machine...all automatically. The stacker nests the ingots and places them in rows as required. Then a conveyor moves the stack out of the machine ready for pickup by a lift truck. The stacker can be pre-set to vary the number of ingots per stack. The spray conveyor cools the ingots so that they can be banded as soon as they are stacked.

This is a good example of the creative engineering for which Treadwell is so well known. In addition, the company is prepared to manufacture similar equipment for automatic casting of copper, lead and other non-ferrous metals. Each installation is adapted to the inherent differences in the metals to be cast as well as to individual production requirements.

You name the time, the place and the problem. A Treadwell sales engineer will be there. In the meantime, ask for a copy of bulletin No. 70, which describes Treadwell equipment.

M. H. TREADWELL COMPANY, INC.
140 Cedar Street, New York 6, N. Y.
1015 Farmers Bank Bldg., Pittsburgh 22, Pa.
208 So. LaSalle St., Chicago 4, Ill.

TR-28

TREADWELL

Non-ferrous
Smelting and Refining
Equipment

How rubber-tired mobility speeds pit production — increases profit

Only a rubber-tired tractor can readily travel from job-to-job in your pit or plant operations. It runs at speeds to 17 mph, shuttles fast between shovel clean-up and other assignments. The operator just shifts into high gear and your tractor is on its way, via haul road or across the pit floor to its next job, whether to strip overburden, level stockpiles, tow other equipment, or switch railroad cars.

Larger pit areas, and higher production requirements, make it necessary to have equipment that can move around fast and easy on its own power.

So the need for high-speed mobility is increasing each year, while the time and cost of moving track-type equipment designed for limited area work becomes higher and higher, cutting profits more and more.

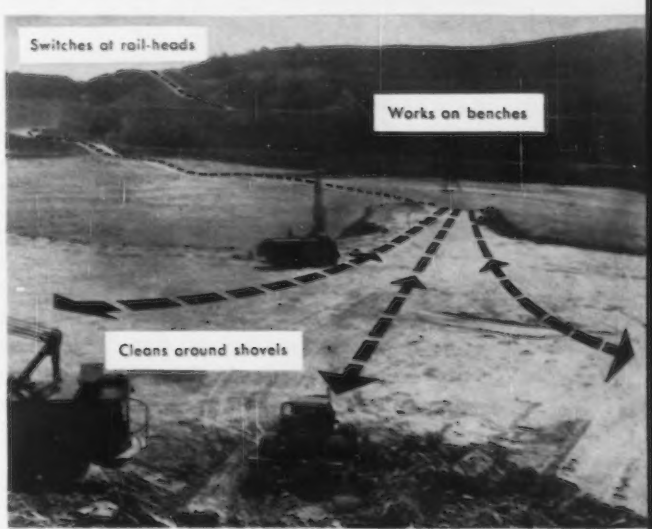
In the light of these developments, it will pay you to consider the importance of *mobility* as a necessary tractor requirement in your pit operations.

Rubber-tired tractor travels at speeds up to 17 mph on work-and-run assignments. Operator can drive over pit floors, or off road. He can road his machine over tracks, ties, switches, and paving, without damage.

Get all 4 . . . power, traction, speed and mobility . . . with Tournatractor®

Tournatractor is a modern tractor designed to provide ample *power*, *traction*, *speed* and *mobility* for scattered pit operations. It does not offer as much drawbar horsepower at speeds below 2 miles per hour as do track-type tractors of equal engine horsepower. But for pit operations where you *can* capitalize on *speed* and *mobility* — we suggest you consider the *new* Tournatractor. The cost is 10% below that of track-type tractors with torque converters and comparable engine horsepower . . . and maintenance costs are lower.

There's a bonus-value for you in today's improved Tournatractor. A railroad coupler attachment is now available, converts this machine quickly to a practical SwitchTractor*. With coupler at one end, and dozer at the other, unit does double-duty . . . makes it an even more profitable tool for your pit operations. Your Le-Tourneau-Westinghouse Distributor will be happy to arrange a demonstration of a Tournatractor in your pit, to prove that its special work advantages — *speed* and *mobility* — can pay real dividends for you. Ask him now . . . or write the factory.



Sketched lines show range of rubber-tired tractor in typical mine. In foreground, tractor cleans-up around shovel. It ranges over entire pit floor for dozing, and on benches bordering the pit. Rail-head is only a few minutes drive away for switching work.

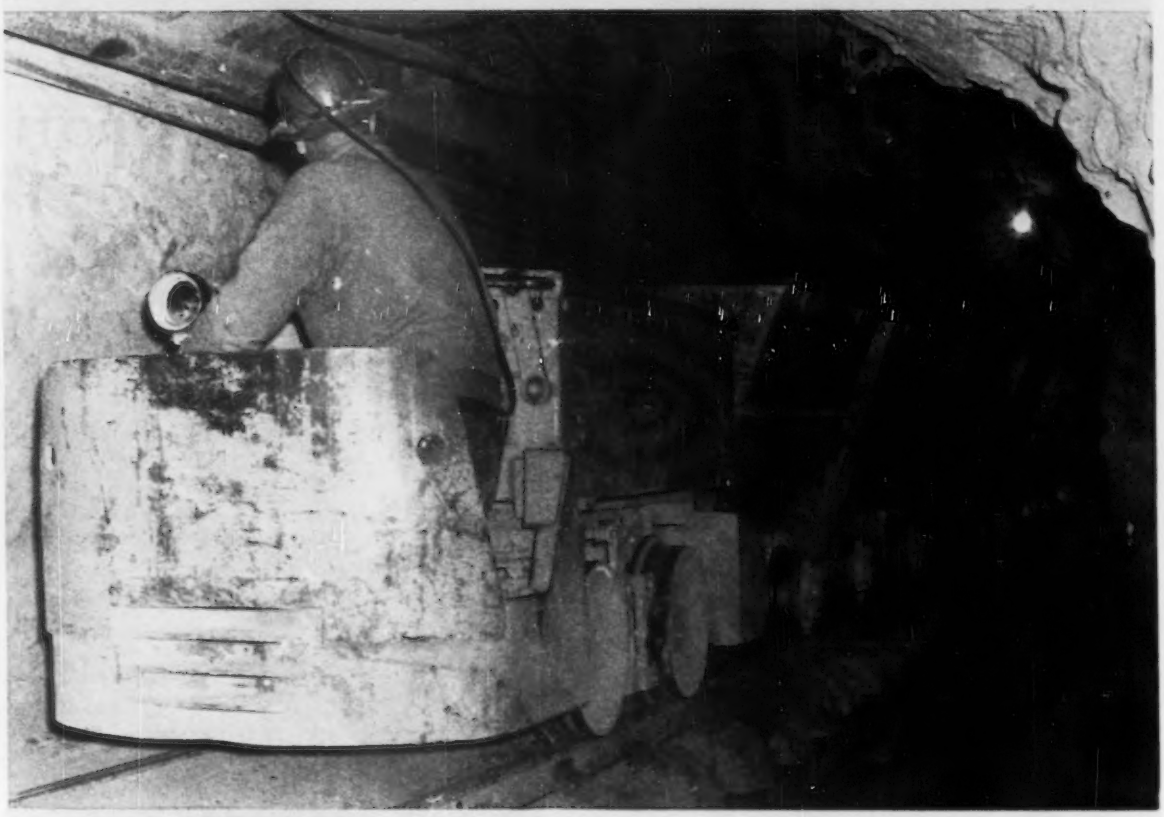
*Trademark CT-1614-M-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

MANCHA STORAGE BATTERY LOCOMOTIVE



Expediting Track Haulage of Uranium Ore

In the uranium rich areas of the Colorado Plateau and Canada's Blind River District 25 recently delivered Mancha 3-ton storage battery locomotives are providing low cost underground haulage.

Practical anywhere underground, these locomotives are maneuverable enough to service loaders in development headings . . . powerful enough to handle small mine production tonnage. Six to ten rocker dump cars, each carrying 1½ to 2 tons of ore is not an unusual load, and 150 tons per shift over a distance of 1,000 feet is just another job to them.

Mancha's patented Trackmaster design smooths out uneven track . . . cushions the battery as well as the motorman from a rough ride. More so, it improves overall performance by providing even drawbar pull to all four wheels through longitudinal equalizers and self-aligning journal bearings. The motor in the front end cast steel cab, is hooded to shed water and muck. A similar hood protects the controller.

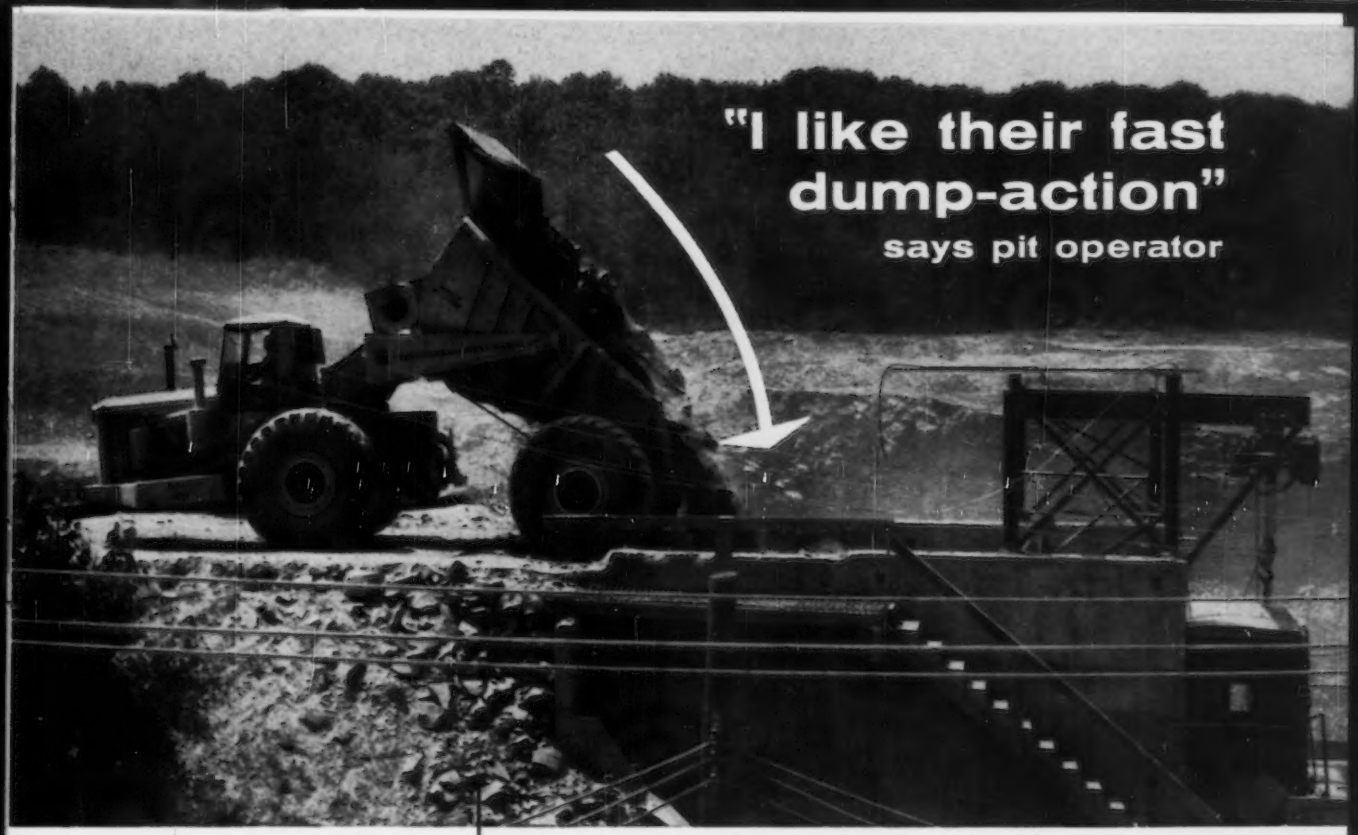
In all respects, the Titan BN (3-ton operating weight) is a powerful—safe locomotive. What it provides in haulage economy for others, it can provide for you. Your inquiry is invited.

MANCHA STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois • Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.



"I like their fast dump-action" says pit operator

Tournapull operator dumps 22-ton load of rock into grizzly fast, and without spillage, because entire dump is under power-control. At full dump position, edge of bowl is low and behind rear wheels . . . material cannot roll forward to lodge against wheels, nor pile under rear end. Operator Gene Arsenault says, "These Rear-Dumps work and get around where a truck won't. They operate easy . . . we've had no trouble with the electrical system."

Material Service's Rear-Dump is loaded with 22 tons of rock in less than 3 min. Shovel operator does not have to take it slow and easy when loading Tournapull haulers. Unit's *all-steel* body — with sloping sides, and trilevel bottom—resists shock and crushing damage of loading heavy rock. Low, wide bowl permits dipper to swing-in and out *low* . . . for faster loading and minimum spillage.

At their East Granby, Connecticut pit, Materials Service, Inc. of Windsor Locks, produces 500,000 tons of crushed hard-trap rock per year. To help maintain production, two LeTourneau-Westinghouse C Tournapull® Rear-Dumps haul 80% of the rock from pit to crusher. Here's how these electric-control pivot-steer haulers perform:

Haul 22-ton loads up 11% grade

With 8 passes, the 2½-yd. shovel fills L-W Rear-Dumps with 22 tons of rock in 2 min. 51 sec. Units haul 1550′ from pit-floor to grizzly — including 500′ of 11% grade — in 3 min. 24 sec. At plant, Tournapull haulers make a tight U-turn, back up to grizzly, and dump their load in 12 sec. Rear-Dumps then return to shovel in 3 min. 4 sec., completing steep 3100′ cycle in 9 min. 31 sec.

Pleased with the performance of their Tournapull Rear-Dumps, owner Angelo Roncari says, "These units have done all we've expected of them. Best of all, I like their fast dump-action."

Electric-controls, simplified construction

Tournapull hauler's smooth, quick dump-action, is largely due to its electrical-control system and simplified construction. When operator flips toggle-switch on dash, point-of-action electric-hoist-motor is activated instantly. Body raises quickly to desired angle. There's no delay for hydraulic pressure build-up, no shock-loads — as with gravity dumping. And with only a few places to inspect and lubricate, maintenance time on rugged Rear-Dumps is greatly reduced.

See Rear-Dumps in action

To increase your production and lower maintenance costs, investigate modern Tournapull Rear-Dumps. There are 3 sizes: 11, 22, and 35 tons. Call or write for complete details, or let us show you these speedy haulers in action.

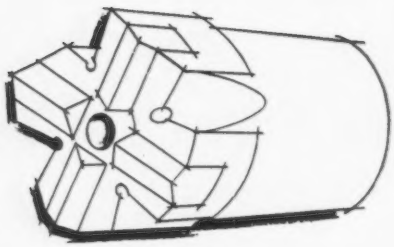
CR-1662-QMJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

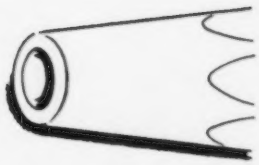
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

NOW!



REMOVABILITY



AND

ONE-PIECE STRENGTH

IN AN AIR-LEG BIT!

AIR-LEG drillers, now you can have your cake and eat it, too. The new Timken® tapered socket bit is removable—yet gives you the strength of one-piece steels. The secret is the taper. It gives you all the advantages of removability with a strong, secure union.

Here are a few of the plusses you get with the Timken tapered socket but can't get with intraset steels because they're not removable.

1. You don't have to throw away the drill steel just because the carbides wear out. You do with an intraset steel.

2. You carry just a pocketfull of bits into the mine. Try putting an intraset steel in your pocket.

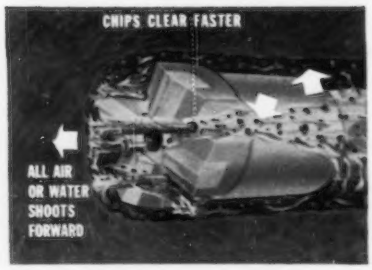
3. You can quickly change bit gage sizes using the same steel. With an intraset steel, you have to change a whole steel.

4. You don't have to lug the whole steel back to the shop to resharpen the cutting edges. You do with a 4-point intraset steel.

5. You get four carbide cutting edges. You get only two with a chisel intraset steel.

And you get further economies because the Timken tapered bit clears chips faster. The picture at right shows you how. New special-analysis carbide inserts give superior wear-resistance with added shock-resistance. And they can be reconditioned many times.

For removability *and* strength, use the air-leg bit of the future. Write for our free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



CHIPS CLEAR FASTER because 1) new five front holes shoot water or air directly against the rock face and 2) new deeper, wider wing clearance lets chips wash back faster.

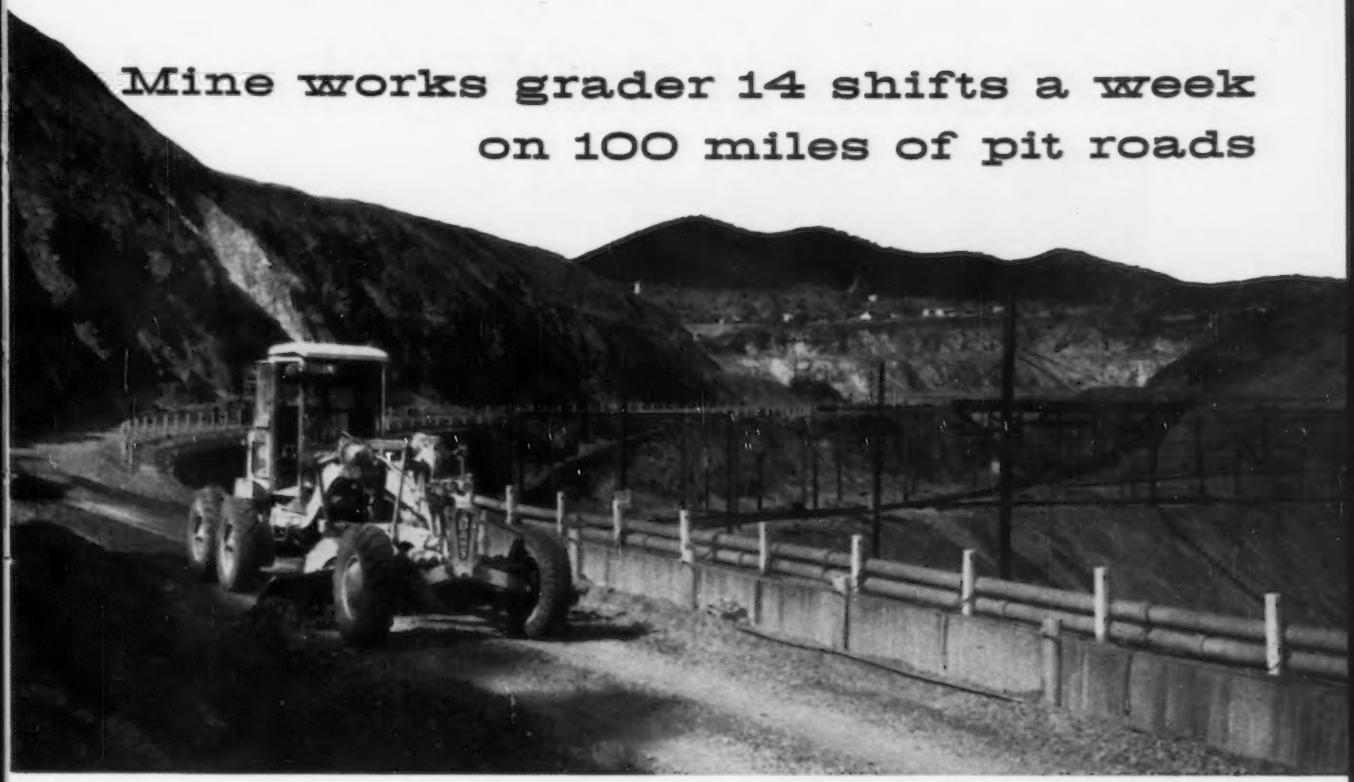
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

AVAILABLE NOW!

THE AIR-LEG BIT OF THE FUTURE

Mine works grader 14 shifts a week on 100 miles of pit roads



Fast-moving Adams 550 grader does lion's share of maintaining more than 100 miles of bench roads at big copper mine. This 123 hp unit grades, ditches, backslopes, does scattered clean-up work.

Two shifts a day, 7 days a week is the rugged schedule of work for a 550 Adams* motor grader at a big southwestern copper mine. 4 to 6 operators take turns manning this heavy-duty unit as it hustles about . . . maintaining more than 100 miles of steep, winding mine roads.

Adams handles many jobs

Roads at the mine coil around the huge open pit, along wide benches 15′ to 20′ high. Surfaced with crushed stone, roads vary in width from one to six lanes. Usually working in 2nd gear, the Adams 550 grades fast and accurately. It ditches, backslopes, does all-around work — such as filling ruts, leveling ridges, and cleaning up debris fallen from banks or spilled from haul units.

Tough assignments, long hours, are right down Adams' alley. Built to withstand severe stress and strain, these graders can take it!

Structurally, the "550" has a big, all-steel box frame for lasting strength and rigidity. It is continuous-welded to take stresses as a unit — from bolster plate to boxed-in rear end. Streamlined, front to rear, this Adams frame has no sharp bends, no cross-section welds, no bolted or riveted joints to break. Front axle is made of welded heavy bar and plate . . . with yokes, kingpins, and spindles of forged, heat-treated steel. This rugged frame foundation, outstanding in the industry, is a basic factor in Adams' accuracy of control, low power loss, and speed as well as its dependability and economy of performance.

Power-wise, the two engines from which you can choose have been job-proven in more heavy-duty construction and road maintenance use around the world, than any other engines available anywhere. Mechanically, all gears and shafts run on anti-friction bearings, and all clutches slide on ball bearings. The 8-speed transmission is the finest ever built for use in a motor grader.

Adams lasts longer, works harder

Net result is a motor grader that lasts longer, works harder . . . with less upkeep. From the utility 220 model, with 60 hp . . . through 80, 115, 123, and 150 hp sizes . . . to the big torque-converter POWER-*Flow* 660, with 190 hp . . . Adams gives you more grader for your money.

Look into the Adams line of heavy-duty motor graders. Your LeTourneau-Westinghouse Distributor has all the facts and will be pleased to arrange a working demonstration of the model that fits your needs best.

Twisting uphill grading is done faster with Adams 550, because it offers *several* full-power speeds for each kind of work. With 15-speed transmission available, operator can always select gear that will get the most work done at the lowest cost. *Trademark G-1485-M-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Queen of the big shovels

55-CU.-YD. DIPPER makes a bulldozer look small. The Tiger Brand Wire Rope is 2⅝" in diameter.

THE RIVER QUEEN, largest shovel ever built by Bucyrus Erie. Now operating in the River Queen mine near Central City, Kentucky. The mine is owned jointly by W. G. Duncan Coal Co. and Peabody Coal Co. It is operated by Peabody.

can move 100,000 tons daily

with "muscles" of Tiger Brand Wire Rope

IN LESS THAN A MINUTE, the River Queen can scoop up an 80-ton bite of rock and earth, pile it 295 feet away and be ready for the next bite. That's fast digging!

The River Queen is the largest power shovel that Bucyrus Erie has ever built. It has a 55-cubic-yard dipper and is as high as a 13-story building.

The wire ropes that harness the tremendous power of the shovel are all U.S.S. American Tiger Brand. The two twin-reeved hoist ropes are 2⅝"-diameter, 6 x 49 Lang Lay Monitor Excellay with Independent Wire Rope Core. The two twin-reeved crowd ropes and the single twin-reeved backhaul rope are of the same size and construction.

The boom supports are eight in number for a total length of approximately 952 feet. These are 2½" Galvanized Boom Support Strands of special design for long service life.

The fact that all the wire rope applications on this huge shovel are handled by standard Tiger Brand constructions emphasizes the quality of the engineering that goes into the complete line of Tiger Brand Wire Rope.

THE BIG BOOM is 145 feet long and is supported by eight 2½" Tiger Brand Boom Supports. Note also the two twin-reeved hoist ropes in foreground.

AMERICAN STEEL & WIRE DIVISION
United States Steel, General Offices: Cleveland, Ohio

The right wire rope will do the trick!

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, New York

USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

KOEHRING WORK CAPACITY *in action . . .*

Here are some figures that will interest you:

KOEHRING MODEL	SIZE DIPPER	LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load.)	
205 CRAWLER	½-Yd.	20,000 lbs.	at 10-ft. radius
205 ON RUBBER	½-Yd.	30,000 lbs. 14,600 lbs.	at 12-ft. radius at 20-ft. radius
305 CRAWLER	¾-Yd.	30,000 lbs.	at 12-ft. radius
305 ON RUBBER	¾-Yd.	50,000 lbs. 15,800 lbs.	at 10-ft. radius at 30-ft. radius
405 CRAWLER	1-Yd.	40,000 lbs.	at 12-ft. radius
445 ON RUBBER	(Crane only)	90,000 lbs. 40,000 lbs.	at 15 ft. radius at 25-ft. radius
605 CRAWLER	1½-Yds.	72,300 lbs.	at 12-ft. radius
805 CRAWLER	2-Yds.	104,200 lbs.	at 12-ft. radius
1205 CRAWLER	3-Yds.	190,000 lbs.	at 12-ft. radius

Want more information? *See Koehring distributor.*

Solid footing on soft banks — Loading gravel off the bottom of a water-filled pit, Koehring 405 dragline (above) holds firmly to the edge of soft, loose banks. Stability of its extra-long, extra-wide crawlers shows up to good advantage in conditions like this. Extra stability means extra work-capacity, too. The heavy-duty 405 handles 1 to 1½ cubic-yard dragline or clamshell buckets on a wide work-radius — boom lengths range from 40 to 90 feet. Butt-connected boom is solid, safe. Inserts are easily changed. Check the 405's other work capacities (in chart) — then have Koehring distributor demonstrate what it will do on your lifting, loading, stripping, stockpiling.

Quarry rock — ¾-yard 305 loads out Lannon stone in a Mid-West quarry. It's a rugged rock shovel, with exceptional operating ease. Big 23-inch main-drum power clutch requires only 1/10th the lever-pull of a comparable-size manual clutch — yet, retains "feel" of load.

15-ton handyman — With its heavy lift capacity and high-speed mobility, Koehring 205 truck crane is a handy material-handling rig to have around. It unloads heavy equipment and supplies, installs machinery — converts to ½ to ¾-yd. clamshell or dragline, ½-yd. shovel, hoe.

Big stripper — Look at the work range of this big 1205 high-lift shovel. It digs up to a height of 42 ft.-10 in. at 45° boom angle — dumps at a height of 31 ft.-5 in. That's with a 3-yard dipper on 40-foot boom. *Need more reach?* It also takes a 2½-yard dipper on a 50-foot boom — has 51 ft.-4 in. cutting height, and 40 ft.-10 in. dumping height, at 45° angle! For heaviest digging, the standard 1205 has 3-yard dipper on 30-foot boom. On dragline or clamshell work, it handles 3 to 4-yard buckets on 60 to 170 feet of boom. *Want more facts?* See Koehring distributor for complete story on this big 1205. Call today.

KOEHRING DIVISION OF KOEHRING COMPANY, Milwaukee 16, Wis. 6748

Keep power costs down and production up with modern heavy-duty CAT Diesels!

Ruggedly built for the hard work, they provide economy, dependability and long life that can't be matched for profitable mining

There's nothing tougher on engines than a mining operation. There's no place anywhere along the line for a "weak sister." Every unit, whether it powers machinery or generates electricity, is vital to a steady production flow. That's why your best investment is Caterpillar power. Every Caterpillar Diesel, from the smallest to the largest, is built to work day after day at the lowest possible cost.

Consider economy! No guessing about this—you can see what you save using Cat Diesels. They run without fouling on a wide range of fuels including low-cost No. 2 furnace oil. Pre-combustion chambers make certain all the injected fuel is used. You save substantially on maintenance, too. The fuel system requires no adjusting. A few minutes' care a day keeps any Cat Diesel in top shape.

Consider dependability! No gambling on this—on operation after operation, Caterpillar Diesels have proved their ability to stand up under shock loads, dust and long hours. This stamina is designed into 'em. For example: Efficient air, fuel and oil filters and seals keep dust and abrasives out, eliminate premature wear and lengthen trouble-free periods of performance.

In the isolated Red Canyon District, Utah, Radium King Mines Inc. relies on Caterpillar power 24 hours a day, 7 days a week, 12 months a year. All electricity for the entire operation and camp, 70 miles from the nearest town, is supplied by a Cat D326 (Series F) Electric Set. Production of uranium ore averages between 3,000 and 5,000 tons monthly.

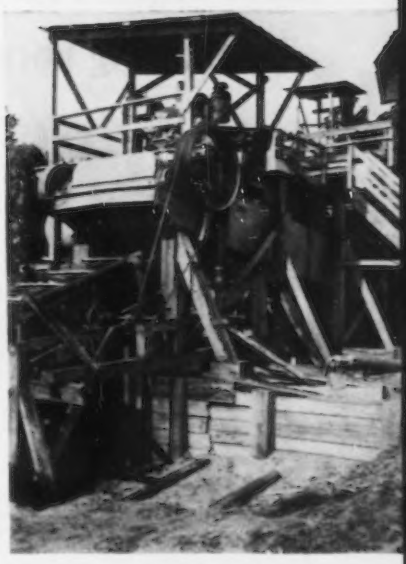
BY CATERPILLAR

Consider long life! Look under the hide of rugged Caterpillar Diesels and you'll see feature after feature that contributes to long life. Examples: Full-length cooled cylinder liners, aluminum alloy bearings, chrome-faced piston rings and crankshafts with "Hi-Electro" hardened and Superfinished journals. More proof that quality workmanship pays off: Used Cat Diesels bring top resale prices!

Your Caterpillar Dealer is a power expert. Let him help you select the right fit of power for your needs. His line-up of engines ranges from 65 HP to 650 HP—electric sets, from 30 KW to 350 KW. Each is honestly rated and certified for capacity. Remember, though you may pay a little more for a unit to start, you'll get a lot more back in profitable production!

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



Powering a long washer, crusher and shaker in an iron ore operation in Glenwood, Alabama, this Caterpillar D337 (Series F) Engine is one of several on the job for Glenwood Mining Co. I. D. Gibson says: "This is one operation you have to keep going or down time will kill you. You have to have machines that will stay on the job. We have found that these products give us better results and longer life."

This Cat D326 (Series F) Electric Set, rated at 100 KW, is the power heart of the Radium King operation. It supplies 110-volt current for lighting mine, office, trailer camp and shop. Hoist, fans and other heavy functions draw 440-volt current from the set, which also powers battery chargers. A D7700 serves as stand-by.

Caterpillar Fuel Injection System offers these time-proven benefits: It maintains loads for long periods without power drop; idles smoothly and runs steadily on all cylinders; handles variable loads with quick response; burns a wide variety of low-cost fuels without added maintenance cost; is free from frequent checks and adjustments.

Cylinder liners typical of quality in Cat Engines. Full-length, wet-type liners in all Cat Engines give more efficient heat transfer—carry the heat away from combustion area—give longer piston, ring and liner life.

Air for drilling at the Radium King uranium operation is furnished by this compressor, powered by a Caterpillar D13000 Engine.

Dept. EM2, Engine Division
CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

Send me more information about Caterpillar Diesel Engines. I have checked the proper box to guide your selection of material.

☐ I would like detailed information, as I may be in the market for a Cat Diesel Engine or Electric Set. I understand I am under no obligation.

☐ I am interested in learning more about these engines.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

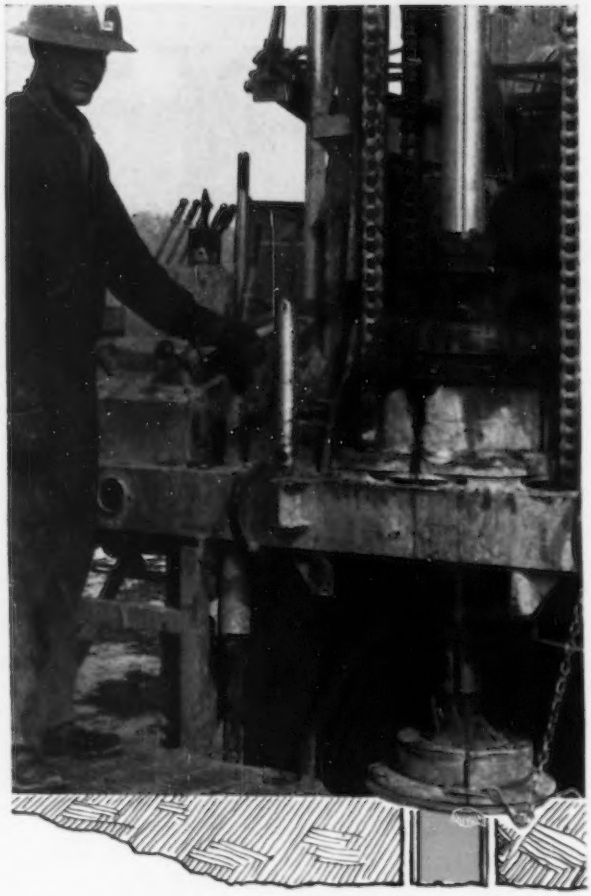
Rides with the bit through rock

...speeds big bore hole cuts...

GARDNER-DENVER

"MOLE-DRIL"*

*TRADE-MARK



Here's added power for your rotary rig—hard-hitting, in-the-hole power. "Mole-Dril" speeds deep hole drilling in ore and overburden.

It's easy to use—the "Mole-Dril" screws directly onto the bottom of standard drill pipe . . . a tungsten-carbide "X" bit screws directly onto drill tappet. That's all the "make-ready" it takes to send the "Mole-Dril" through rock.

It's powerful—"Mole-Dril" delivers more foot-pounds of energy to the bit than any other drill of its size. Every pound of hammer energy is transferred directly to the bit.

It's rugged—the "Mole-Dril" has only three moving parts, nine major parts. This simple, rugged construction gives the "Mole-Dril" lasting deep hole drilling durability.

Two models available:

Model AM4 for drilling 4¾" diameter hole.
Model AM6 for drilling 6½" diameter hole.
Write for bulletin.

"Mole-Dril's" positive hole cleaning action

Air at full line pressure flows through drill's air blowing tube directly to bit . . . this direct air stream keeps cutting face clean regardless of drilling depth.

Drill exhaust air passes out up-cast air ports and gives cuttings an additional out-of-the-hole boost.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

E&MJ NEW PRODUCTS DIGEST

In this issue—over 160 new product and new literature notices. Please note that the second readers' reply card has been changed to make room for so many items. Page 68 is all new literature for metal and mineral processing, while the space on the reply card page concerns exploration, mining and auxiliary aids. Be sure to give your name and address.

Ford Enters Heavy-Duty Truck Field (1)

Ford Motor Co. introduced a new line of heavy-duty trucks, with gross vehicle weight of 19,500 lb and up, at a national press conference held in Louisville, Ky., Jan. 10. A doubling in demand for trucks in this range during the past eight years prompted Ford to supplement its light-truck line with heavy units. The new line includes tilt-cab units (shown above), and conventional and tandem units ranging from 25,000 to 51,000 lb gross vehicle weight, and total load (vehicle plus load) ranging from 50,000 lb to 75,000 lb.

Trucks will be powered by gasoline engines because, according to Ford surveys, 80 to 88% of all trucks in the heavy field have been built with gasoline engines during the past 10 years. Engine models for the new line have displacements of 401, 477 and 534 cubic in., and will develop 226, 260 and 277 gross hp, respectively. Compression ratio of 7.5:1 was selected for engine design because this will accommodate the lowest grade gasoline which truck operators are frequently forced to use in some areas.

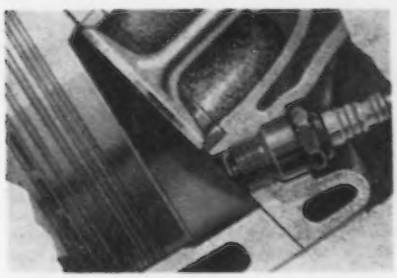
Engine designers told reporters that they were given an unusually free hand in developing the units used on the truck. Large sums were expended in making prototypes of present engines before an optimum design was accepted.

Special design features include the step-top piston which closes in on a wedge-shaped combustion chamber (see illustration above). This design is said to improve turbulence, give better combustion control, and develop smoother balanced power impulses.

A three-stage thermostat system which limits circulation first to the head, then to head and block, and finally to the entire cooling system including cab heater and radiator operates at two cut-in points—140- and 160-deg F, respectively.

Instead of conventional generators, the engine powers an alternator which develops direct current through a selenium plate rectifier mounted behind the radiator grill for cooling purposes. The only time the truck battery is used is to start up the engine. Then all power required for motors, ignition, lights, etc. is developed through the alternator.

WALKING-BEAM ACTION of tandem rear axles keeps trucks from bogging down under rough road conditions; battery used to start motor only.



WEDGE-SHAPED combustion chamber in block is designed to improve fuel-air mix. Alternator replaces conventional generator.

Oil filters and air compressors are mounted integrally to the block to eliminate external piping. Weight saving in engine design and frame construction has increased pay load by as much as 2,000 lb on the new models.

Specification sheets are now available enabling the truck user to obtain a combination of engine horsepower and speed ranges, transmission ratios, etc. that will perform satisfactorily under a wide range of load, speed and road conditions. Tandem-axles with load-grip adjustments have been designed to permit trucks to pull loads with drive wheel axles twisted as severely as shown above. A special lever enables the driver to shift load grip from a spinning wheel to another drive wheel in slippery spots.

For more information on these items and for copies of the free literature listed on the reply card opposite page 68, circle the proper numbers, give your name and address, and mail.

Safety Block Saves Lives (7)

Boliden Mining Co. is using two hundred Sala Safety Blocks above and underground. Units are very popular with the men, says T. Sjoqvist, Boliden safety engineer, since they permit the men to work in safety in places where the risk of a fall is high. Sala Safety Blocks are available in the U.S. and Canada from Tenace Tools Ltd.

Earthmovers Get Bigger

R. G. LeTourneau, Inc.'s giant electric log stacker above can lift and place a 22-ton load. LeTourneau says that if anyone wants it, they can put a 25-ton bucket on the machine and convert it to a front-end loader. **(8)**

A planetary-axle tractor and a matched bottom-dump trailer with a rated capacity of 50 tons has been developed by Autocar Div., White Motor Co. **(9)**

Rubber-tired, four-wheel drive 1¾-yd loader will be available from Oliver Corp. in 1958. Unit will be equipped with torque converter and have an unusually high bucket lift. **(10)**

Dumping angles as high as 80 deg on some models and as high as 60 deg on long bed trailers are available on Loadmaster Co.'s line of dump trucks. Models range from 10 to 30 cu yd capacity. **(11)**

Four-wheel drive, rear-wheel-steer tractor-loader in the 1¾ cu yd class is now available from J. I. Case Co. Three interchangeable bucket sizes from 1⅜ to 2¾ cu yd available. **(12)**

All welded aluminum alloy truck bodies up to 35-ton capacity are being made in Heil Co.'s Milwaukee plant. Trucks are being used at Caribbean bauxite operations. **(13)**

Le Tourneau Westinghouse has available an 18 cu yd bowl scraper for use with tractors of 90 hp and larger. Unit is designated the CT Scraper. **(14)**

Model TG-45 and TG-50 towing tractors from Allis-Chalmers Manufacturing Co. can be had with gasoline, diesel or LP gas engines. Units have pulling capacity of 90 to 100 tons on level surface. **(15)**

McCormick U-34B Power Loader can be attached to an International Harvester 330, 300 or 350 utility tractor. Unit can be powered either by tractor's Hydra-Touch hydraulic system or with a special large capacity front-mounted hydraulic pump. **(16)**

Dumping clearances of 13 ft 10 in. under the hinge pin and 11 ft 4 in. under the bucket lip are possible on the 2 cu yd TL-20D Tractoloader manufactured by Tractomotive Corp. **(17)**

Eleven-ton Model D Tournapull rear dumper is designed for underground use. Unit is only 8 ft 11 in. high while hauling, and 11 ft 8½ in. in dump position, says LeTourneau Westinghouse Co. **(18)**

Giant Feeder For Crushers (19)

A huge Amsco feeder that can deliver 550 tph (72 in. wide on 46 ft centers) has been delivered to Union Miniere du Haut Katanga in the Congo. Stephens-Adamson Mfg. Co. says that an almost identical unit was delivered to Katanga in 1948, shows little sign of wear.

Adjustable Speed Drive (20)

Available in 5 to 200 hp range, the Louis Allis Co. Select-a-Spede drive is a variable voltage dc unit, using ac as power source.

Tubular Welding Wire (21)

Hardfacing costs can be cut by using the new tubular wire electrodes developed by American Manganese Steel for open arc semi-automatic welders (Amsco MF welder). Wire can deposit metal up to 200% faster than with fastest manual rods.

Engineering Office Aids

Microscope - projector - comparator-camera, all in one unit, Alfred Hoffman & Co.'s Projectina can make any enlargement from 7x to 2000x. Photo record can be taken with Graflok back or Polaroid Land back in black-and-white or color. **(22)**

Portable drafting machine, called Draftette, can fit into a briefcase—David Miller & Associates. **(6)**

Phanton Ruled Blutex vellum has its own guide lines in grid fashion—Frederick Post Co. **(23)**

Stud Driving Tool (24)

Model 455A Remington Arms Co. stud driver can anchor studs to wood, steel, concrete or any combination. In addition, the gun will recapture the stud should the stud be fired into a soft or insubstantial material.

Rotary Compressor (25)

Tank-mounted rotary compressors in the 2 to 3 and 5 hp range are available from Davey Compressor Co. Units operate at 100 and 200 psi. Units are small, compact.

Chain and Cable Aids

Fast sling chain service may be obtained with American Chain & Cable Co.'s new localized service. See bulletin on new Accoloy Kuplex chains. **(26)**

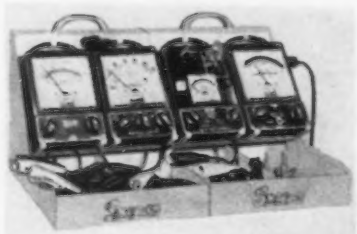
Continuous cable clamp developed by Sauerman Bros. comes in three parts and is quick and easy to assemble. **(27)**

Concreting Aids

Waterproofing agent manufactured by Dakota Engineering, Inc. is said to stop all pressure seepage and water flow through brickwork, concrete or stone. **(28)**

Epoxy adhesive, Carboline Co.'s Concrete Adhesive 192-34, bonds new concrete to old. Can be used to patch damaged floor, etc. **(29)**

Truck Maintenance Aids



Engine and electrical system tester requires no outside 110v power, can be used anywhere—Snap-on Tool Corp. **(30)**

Industrial battery charger permits manual selection of charging rate from 6 to 32v dc output—Automatic Switch Co. **(31)**

Instrument that measures depth of tire tread has been developed by Dill Mfg. Co. **(32)**

Engine indicator analyzes internal combustion pressures, vibrations and voltage —Kistler Instrument Corp. **(33)**

Heavy duty steam cleaner can deliver 280 gph of cleaning solution—Clayton Mfg. Co. **(34)**

Safety Aids

Safety shoes with hard rubber ribs, above the steel toe area, to protect the foot —Lehigh Safety Shoe Co. Sizes 5 to 12. **(35)**

Small compact resuscitator will fit into a shoe box. Bag holds 1.3 liters of air. Oxygen-enriched gas attachment—Schueler & Co. **(36)**

Foot-operated suction pump for emergency use weighs 4½ lb, can pull negative pressure of 280 to 300 mm—Schueler & Co. **(37)**

New line of Mine Safety Appliance Co. safety gloves are available in five molded materials and three surface designs. **(38)**

Chemicals and Reagents

Cooling tower metallo-organic slimicide —El-Tox by United Chemical Corp. **(39)**

Eleven new fatty nitrogen derivatives—seven primary fatty amines (Alamines), three quaternary ammonium chlorides (Aliquats) and a trimethylene diamine (Diam) are available from General Mills. **(40)**

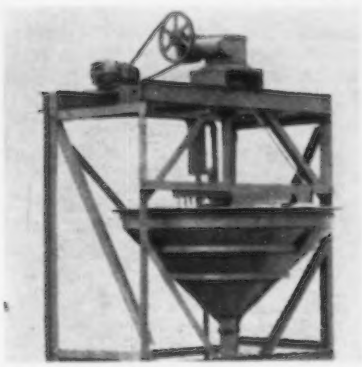
Belting Aids

Easy-to-use, high-strength, flexible lacing for troughing belts has been developed by General Splice Corp. Hinge-type splice needs no templates, drilling or punching. **(41)**

Texalon, a stretch-free, all synthetic belting for mechanical power transmission is a woven nylon textile with extruded nylon core. J. E. Rhoads & Sons. **(42)**

V-belt construction, developed especially for use on oil rig pump and other long center industrial drives, has been announced by Manhattan Rubber Div., Raybestos-Manhattan, Inc. Condor LS Belt. **(43)**

Metal and Mineral Processing



Dewatering vacuum filter developed by Carpco Mfg., Inc. is a shallow inverted cone covered by a perforated disk and filter cloth. Dewatered granular material is plowed off at a uniform rate. Direct reduction drive. **(44)**

No. 105 Kue-Ken Rockeater, heavy duty crusher is designed for gravel or secondary crushing. Available in 42x8, 42x10, 42x12 and 42x14 in. jaw sizes. Capacity is 50 to 150 tph on 40 to 60 hp. Straub Mfg. Co., Inc. **(45)**

Heavy-duty vibrating feeder, developed by Hewitt-Robins, Inc., can handle rock up to 4 ft dia at the rate of 300 to 3,000 tph. **(46)**

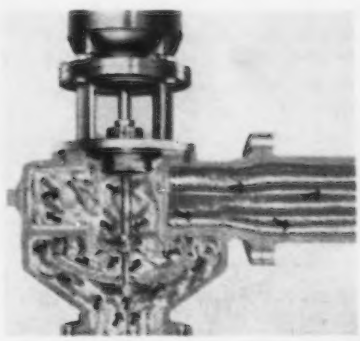
Portable belt conveyor with hydraulic drive, available in 18-, 24-, and 30-in. belt widths, is being marketed by E. F. Marsh Engineering Co. **(47)**

Heat exchangers, in the Ross Heat Exchanger Div., American Standard line, can be examined through bulletin describing their Type BCF units. **(48)**

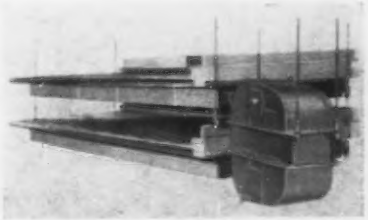
Compact, low-silhouette, general purpose cooling towers with 15 to 200 gpm capacity are being sold by Binks Mfg. Co. Units measure 44 to 84 in. in height. **(49)**

Exothermic gas generators designed to produce inert gas by burning fuel gas under controlled atmospheric conditions are available from A. A. Straub Co. **(50)**

Specially designed fluid agitation research laboratory which will help solve basic mixing, blending and solvent separations problems has been established by Mixing Equipment Co., Inc. This hazardous materials lab can pilot plant up to 600-lb batches. Continuous flow or batch studies involving one, two or three phase systems can be explored. **(51)**



Device designed to be installed in a pipeline to mix fluids flowing through the line, the Nettco Flomix, uses friction flow to blend, mix in one pass. Eight sizes available from New England Tank & Tower Co. **(52)**



Deister Concentrator Co., Inc. has developed a twin-deck coal-washing table, "77". Diagonal deck twins double the capacity for a given floor space. **(53)**

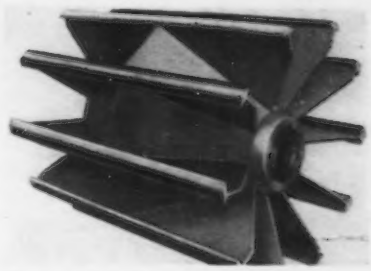
Ohmart Corp. is manufacturing Model LSG radioactive-induced gravity, density and percent solids gage. Unit fits to the pipeline and is enclosed in protective layer. Instruments can be added to record results. **(54)**

Automatic bin level indicator and control unit, manufactured by Bin-Dicator Co., can be installed in hard to get at location. Needs no bolts or nuts. **(55)**

Indicating transmitter for process temperatures in the 100 to 600 deg F range —Foxboro Co. **(56)**

Uniform magnetic fields have been designed into Magnetic Engineering & Mfg. Co.'s new cobbing pulley magnetic separators. Memco cobbing pulley is said to induce 400 gauss lines at a distance of 5 to 6 in. from the pulley face. **(57)**

Ribbon flight dryer permits low heat control at low temperatures in drying tungsten concentrate, says Allis-Chalmers Mfg. Co. Flight dryers are used by Climax. **(58)**



Steel, self-cleaning conveyor pulleys are available from Van Gorp Mfg. Co., Inc. in 3000 standard sizes ranging from 8 to 60 in. dia., and from 8 to 66 in. face width. **(59)**

Fluorometer, developed for the AEC by American Cyanamid Co., is available from Jarrell-Ash Co. Unit was designed to determine trace amounts of beryllium and uranium in liquid samples. **(60)**

Roto-Bin-Dicator's new design is particularly adaptable to installations in bins under pressure or vacuum, in bins, chutes and conveyors where large lumps bridge, and in bins that tend to rat-hole. New unit has a slowly rotating paddle which starts or stops micro-switch, depending on feed height. **(5)**

A Wealth of Processing Literature Briefly Noted

Use Special Reply Card Opposite p 68

Impelator—combining centrifugal force, suction and sheer action to mix—Palo Laboratory Supplies. **(113)**

Hydrocyclone in mineral preparation—a paper, and catalog of glass laboratory units. Liquid-Solid Separations Ltd. **(114)**

DECO Trefoil—H. B. Concentrator is covered in Sept.-Oct. issue. Denver Equipment Co. **(115)**

Processing equipment catalog-bulletin from Bartlett & Snow Co. Kilns, dryers and pressure vessels. **(116)**

H. W. North Co. blenders and mixers and ball mills are shown. **(117)**

Filters, mixers, pumps and tanks from Alsop Engineering Corp. are illustrated in 40 pp. **(118)**

Portable mixers are covered in International Engineering, Inc.'s 16-page catalog. **(119)**

Liquid-vapor separators — Yorkmesh demisters—are made in a number of wire mesh patterns and styles for any vapor-liquid separation problem. Otto H. York Co., Inc. **(120)**

Agitators for every purpose are described in New England Tank & Tower Co. literature. **(121)**

Special processing equipment, vessels and tanks fabricated by L. O. Koven & Brother, Inc. are detailed in 8-page bulletin. **(122)**

Graphite heat exchanger design and function—the Carbone Corp.'s Polybloc unit. **(123)**

Filters for air and steam—Hi-ef LC Purifiers—V. D. Anderson Co. 4 pp. **(124)**

Filters for dry, clean compressed air or gas—R. P. Adams Co., Inc. **(125)**

Data for cost estimation on the use of Falls Industries, Inc.'s Impervite—impervious graphite process equipment. 29 pp. **(126)**

Blenders, mixers, mills, sifters and pony mixers are illustrated in J. H. Kay Co.'s 4-page release. **(127)**

Impervite centrifugal pump—40 gpm capacity—is available from Falls Industries. **(129)**

Multistage contactors and Lightning Mixers are illustrated in Mixing Equipment Co., Inc.'s literature. Gas-liquid and solid-liquid contacting processes can be evaluated for you. **(130)**

Reciprocating and centrifugal compressors—Ingersoll-Rand design. 8 pp. **(131)**

Mixers, agitators, dryers, ball and pebble mills from Patterson Foundry and Machine Co. are displayed in 20-page bulletin. **(132)**

Hot process water softeners are covered in a 24-page bulletin prepared by Cochrane Corp. **(133)**

Impervite tube and shell heat exchangers are illustrated in Falls Industries, Inc.'s 8-page bulletin. **(128)**

Dry processing aids—air separators, blenders and mixers, crushing and milling machines, and the Micronizer are illustrated in Sturtevant Mill Co.'s 8-page release. **(134)**

Herman Nelson Industrial Heater construction, application and performance are detailed in American Air Filter Co., Inc.'s 26-page bulletin. **(135)**

Portable pumping units and suction lines from W. R. Ames Co. are illustrated in literature now available. **(136)**

Processing and laboratory vessels, filters, and valves are presented in Star Tank & Filter Corp.'s latest catalog. **(137)**

Fail-safe electronic regulator that provides precise regulation of line speed, voltage or tension on continuous processes can be examined through a 6-page bulletin prepared by Reliance Electric & Eng. Co. **(138)**

Industrial electric heating units are detailed in Westinghouse Electric Corp.'s 24-page booklet. **(139)**

Bete Fog Nozzle literature states that the company will allow 30-day trial on all items. **(140)**

Tower packings bulletin from U. S. Stoneware. 18 pp. **(141)**

Tower support plates and distributors bulletin from U. S. Stoneware. **(142)**

Packaged automatic boiler bulletin from Orr & Sembower, Inc. is 6 pp. **(143)**

Steam traps and temperature controls catalog from Sarco Co., Inc. **(144)**

International Engineering, Inc., has bulletins available on grinding, mixing, agglomerating, extrusion, mullers, crushers and processing equipment. **(145)**

Bowl mills for direct fired rotary kilns are illustrated in Raymond Div., Combustion Engineering, Inc.'s catalog. **(146)**

For literature on pulverizing, separating and drying units, see Combustion Engineering No. 83. **(147)**

Fluid energy grinding—Sturtevant Mill Co.'s Micronizer. 4 pp. **(148)**

Grinding and mixing equipment—bulletin No. 280. U. S. Stoneware. 23 pp. **(149)**

More on grinding—Patterson Foundry & Machine Co. literature on rod, ball and tube mills. **(150)**

Batch ball and pebble mills for lab or mill—International Clay Machinery Co. **(151)**

Selectro screening bulletin is 8 pages. Productive Equipment Corp. **(152)**

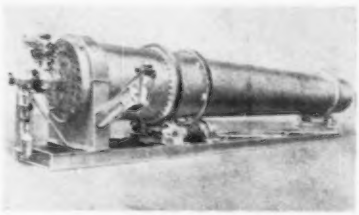
Deister Machine Co. has a new 16-page bulletin on vibrating screens. **(153)**

Raymond Ray-Ducer hammer mill literature from Combustion Engineering. **(154)**

Gyroset adjustable, positive eccentric screen bulletin. Productive Equipment Corp. 8 pp. **(155)**

Continuous conveyor dryers are available from Proctor & Schwartz, Inc. **(156)**

Centrifugal dryer that can handle 60 to 80 tph of coal can be examined in Bird Machine Co.'s literature on the Bird-Humboldt machine. **(157)**



Hersey Dryers are described in Standard Steel Corp.'s bulletin. **(158)**

Continuous presses and dryers bulletin from Davenport Machine & Foundry is 10 pp. **(159)**

Mine, mill and process equipment from Jeffrey Manufacturing Co. is described in small 47-page condensed catalog. **(160)**

Syntron Co.'s condensed catalog covers their lines of vibrators, screens, valves and feeders. 60 pp. **(161)**

Dry chemical feeders and weighing machines—Wallace & Tiernan Inc. **(162)**

Toledo Scale Co. literature on electronic remote dial scales. **(163)**

Corrosion resistant materials and process equipment—U. S. Stoneware. **(164)**

Lead lined and covered process equipment—Knapp Mills, Inc. 12 pp. **(165)**

How to build corrosion resistant floors—U. S. Stoneware. 15 pp. **(166)**

Need rare or refractory metals fabricated or clad for process use? See D. E. Makepeace Co. literature. **(167)**

Five different materials of construction, unique for their high corrosion resistance, are used in General Ceramics Corp. process units. 15 pp. **(168)**

E&MJ NEW PRODUCTS DIGEST (*Continued*)

For More Details on New Product Items Starting on p65 and For Copies of Free Literature Listed Below –Circle the Proper Number on Card. Be Sure to Give Your Name and Address, Then Mail to *E&MJ*

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Mining

ROTARY CAR DUMPER, developed by Heyl & Patterson, Inc., is described in 16-page Brochure No. 957. Unit will dump and return a spotted car in one minute. **(60)**

APA DRAG BIT drill head, by Austin Powder Co., is illustrated in 2-page flyer. **(61)**

MAINTENANCE GUIDE, Caterpillar Tractor's latest operator's aid, is an illustrated 24-page booklet. Prepared for use with D2, D4 and D6 Cats. **(62)**

DRILL SUPPLY CATALOG, Acker No. 58, describes several hundred tools and accessories available from the company. **(63)**

TYPICAL LUMBER DESIGNS, a booklet prepared by Timber Engineering Co., shows over 300 timber structures. 16 pp. **(64)**

CRAWLER - MOUNTED 805 Excavator, designed by Koehring Co., can be used as a 2-cu yd shovel, dragline clamshell or 52-ton lift crane, according to 4-page bulletin. **(65)**

COST RECORD BOOK for truck fleets—36th annual edition—is available from White Motor Co. **(66)**

B-125 ENGINE introduced by Allis-Chalmers can be used with gasoline, low-gravity fuels or natural gas, according to 8-page illustrated bulletin. **(67)**

ACCESSORIES and attachments for Allis-Chalmers motor graders can be examined in 4-page bulletin. **(68)**

SELF-PROPELLED shovel crane, Model SP-107 by Thew Shovel Co., is illustrated in 16-page catalog. **(69)**

MOTO-CRANE, Model MC-530 by Thew Shovel Co., has full-rated 35-ton lifting capacity. 8-page bulletin. **(70)**

SYNCROGEAR MOTORS, right-angle type GW, developed by U. S. Electrical Motors, Inc., are displayed in 8-page release. **(71)**

ELECTRIC MOTORS up to 400 hp are cataloged in Master Electric Co.'s 8-page folder. **(72)**

IMMERSIBLE MOTOR designed by Louis Allis Co. is available in ¾- to 40-hp polyphase and ¾- to 5-hp single phase, according to 4-page bulletin. **(73)**

TOTALLY PROTECTED ac motor from Reliance Electric and Eng. Co. is illustrated in 4-page bulletin. One to 125 hp. **(74)**

LARGE HIGH-SPEED synchronous motors, 1500 hp and larger, either vertical or horizontal, are illustrated in General Electric Co.'s 8-page bulletin. **(75)**

ROTARY AIR COMPRESSORS by American Brake Shoe Co. come in 1- to 2-hp, 150 to 175 psi sizes, according to 8-page release. **(76)**

Auxiliary Equipment

FIRE FIGHTING equipment in the Ansul Chemical Co. line is illustrated in 24-page catalog. **(77)**

GEARS AND DRIVES by Foote Bros. are presented in 4-page bulletin. **(78)**

WORM GEAR DRIVES, designed by Cleveland Worm Gear, are illustrated in 16 pp. **(79)**

SPEED VARIATOR — ball bearing drive—is presented in 8 pages by Cleveland Worm Gear. **(80)**

GEARS AND REDUCERS from Philadelphia Gear Works, Inc. are set forth in 4 pages. **(81)**

GEARS, COUPLINGS AND FLUID MIXERS by Philadelphia Gear Works, Inc., can be examined in their 8-page bulletin. **(82)**

BEARING UNITS in the Browning Mfg. Co. line are illustrated in 12 pp. **(83)**

HARMONIC DRIVE—power transmission device—what it is and what it can do, is presented in 4-page release from United Shoe Machinery Corp. **(84)**

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Please send me the catalogs or futher information about the items from New Products Digest whose numbers are circled. **FEB. 1958**

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

GET MORE FROM YOUR DRIVE DOLLAR is the title of Foote Bros. engineering manual No. 3 that describes straight line and right angle reducers in 40 pp. **(85)**

ELECTRIC DRIVES from Master Electric Co. are displayed in 4-page folder. **(86)**

INSULATION SOLUTIONS for all temperature problems is a 2-page table prepared by Mundet Cork Corp. **(87)**

DRUMS—steel or fiber—in a variety of sizes are available from Virginia Barrel Co. **(88)**

DISTRIBUTION PANELBOARDS, Type QMR from General Electric, are presented in 4-page bulletin. **(89)**

CHEMICALS for roadside vegetation control, a paper presented before the American Road Builders' Association, is available from E. I. du Pont de Nemours & Co. **(90)**

CASTABLE REFRACTORIES from Robinson Clay Products Co. can be examined through literature available from the company. **(91)**

WALL CONVERSION CHART prepared by Precision Equipment Co. gives common conversion factors for many units of measurement. **(92)**

WELDING SUPPLIES and accessories catalog available from Air Reduction Sales Co. contains complete ferrous and nonferrous welding rod data in 48 pp. **(93)**

HOW TO MEASURE your filing costs and efficiency is the title of a 28-page manual now available from Remington Rand. **(94)**

TRANSFORMER ENGINEERING manual, published by R. E. Uptegraff Mfg. Co., covers four series of dry-type transformers. 12 pp. **(95)**

COAL-ALARM system prevents coal supply failure in coal-burning units, according to 2-page data sheet prepared by Richardson Scale Co. **(96)**

MACHINE SHOP TOOLS—Niagara Ring and Circle, Circle and Slitting Shears—are illustrated in an 8-page bulletin. **(97)**

GAS WELDING CATALOG, prepared by Modern Engineering Co., is a revised 36-page release. Applications and equipment available are shown. **(98)**

HAULAGE WAYS for December contains a discussion on the use of Ohio Brass's O-B cable fault locator. **(99)**

CONVEYOR DRIVE CHAIN and sprockets from Browning Mfg. Co. are illustrated on a one-page release. **(100)**

WHICH ELECTRODE TO USE? is the title of a 24-page welding guide release by Metal & Thermit Corp. **(101)**

FLEXIBLE SHAFTS in the 10- to 800-hp range are cataloged in literature prepared by H. S. Watson Co. **(102)**

MACHINERY CONSTRUCTION KIT enables engineers to make precision working models of practically any type of machine, drive or mechanism, says FAC Div., Overseas Commodex Corp. **(103)**

CASTABLE REFRACTORIES and gunning materials—Firecrete and Blazecrete by Johns-Manville—can be examined through 12-page bulletin For temperatures to 3,000 deg F. **(104)**

CASTINGS—heat and corrosion resistant—available from General Alloy Co., are set down in a 3-page table. **(105)**

HIGH STRENGTH STEEL PLATE, for every construction trade, is available from Colorado Fuel & Iron Corp. in their Clay-Loy brand, according to latest release. **(106)**

ADVANCED MATERIALS TECHNOLOGY—a new quarterly publication by Carborundum Co.—features technical data on materials to meet severe operating conditions. KT Silicon Carbide is covered in the first issue. **(107)**

CASTINGS available from Lebanon Steel Co. are presented in 4-page bulletin. **(108)**

TITANIUMS corrosion resistant qualities are explained in Republic Steel Corp.'s 4-page bulletin. **(109)**

WHAT IS McNally Pittsburg?—a company profile prepared on the equipment and services available is 37 pp. **(110)**

ACID-RESISTANT and lint-free industrial clothing is described in the Worklon, Inc.'s catalog. **(111)**

CHAIN OILERS designed by Trico Fuse Mfg. Co. are detailed in a 4-page release. **(112)**

In secondary blasting, it's easier to connect and ignite all safety fuse with Quarrycord

Prime with safety fuse and blasting caps. You'll play-it-safe two ways:

- No danger from stray electrical currents or thunderstorms.
- No big "boom!": you get a series of small shots: "pop-pop-pop".

Connect and ignite your safety fuse primers with Quarrycord and play-it-safe *again* because—

- No men on the rock pile. The entire blast is set off by *one* man at a point where escape is safe and easy.

Quarrycord is packed on spools in 100-ft. lengths. It is easily lighted with a match and burns with a very hot open flame at the rate of about one foot per second.

HOW TO USE QUARRYCORD

Cut your safety fuse in equal lengths as prescribed by your State law, and prepare your primer cartridges. On the end of the fuse opposite the blasting cap place a Connector. This is a metal tube containing an ignition compound in the slotted end, and color-banded for easy identification. Load and tamp the holes.

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Connect your main lines with cross lines wherever these will cut down the over-all burning time. Lead main lines off to a point away from the rock pile. When all is ready, light this end with a match and go to a place of safety. Q-4

It's quite a story, told completely in this folder which we'll send you, free, when you ask for it. Write today.

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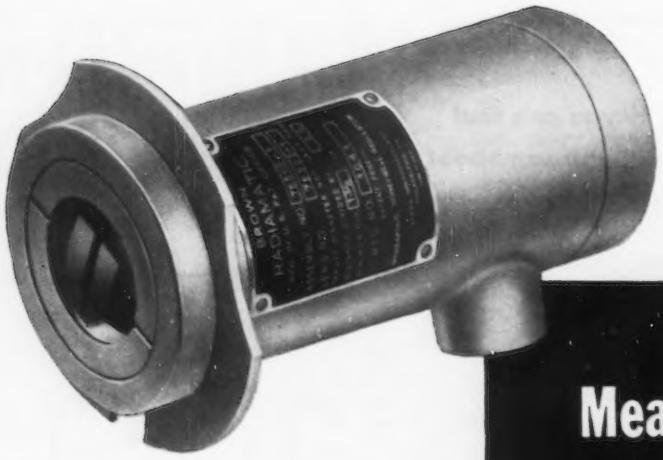
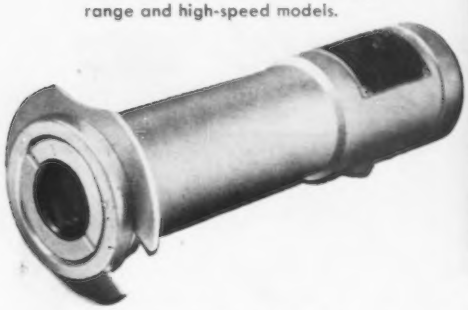


General Purpose *Radiamatic* Unit — for applications in the temperature range from 200 to 4000 F. Available in low, intermediate and high-range and high-speed models.



Small Target *Radiamatic* Unit — for temperature range from 1700 to 7000 F. Available in five models, depending on size of target and temperature requirements.

Miniature *Radiamatic* Unit — for range from 200 to 3200 F. For use where space is limited and small targets must be observed at short distances.

Measure "problem" temperatures with a *Radiamatic* temperature detector

USE *Radiamatic* detectors to measure the temperature of moving objects without physical contact . . . or for representative temperatures over large areas . . . or where abrasion, vibration, shock or corrosive atmospheres exist. *Radiamatic* temperature detectors are used extensively in pelletizing, in reduction and beneficiation of low grade ores—where thermocouples can't be used.

These detectors operate faster than thermocouples. You can easily interchange various types of *Radiamatic* units in your installation to meet changing requirements. They're reliable, maintenance-free production aids that give long service in any application. *Radiamatic* detectors have ambient temperature compensation to 350 F.

There's a complete line of *Radiamatic* accessories—sighting and target tubes, mounting frames, supports, air and water cooled fittings —where necessary—for varied installation needs. And there's a complete line of Honeywell indicators, recorders and controllers for use with these units.

Get complete details from your nearby Honeywell field engineer. He's as near as your phone.

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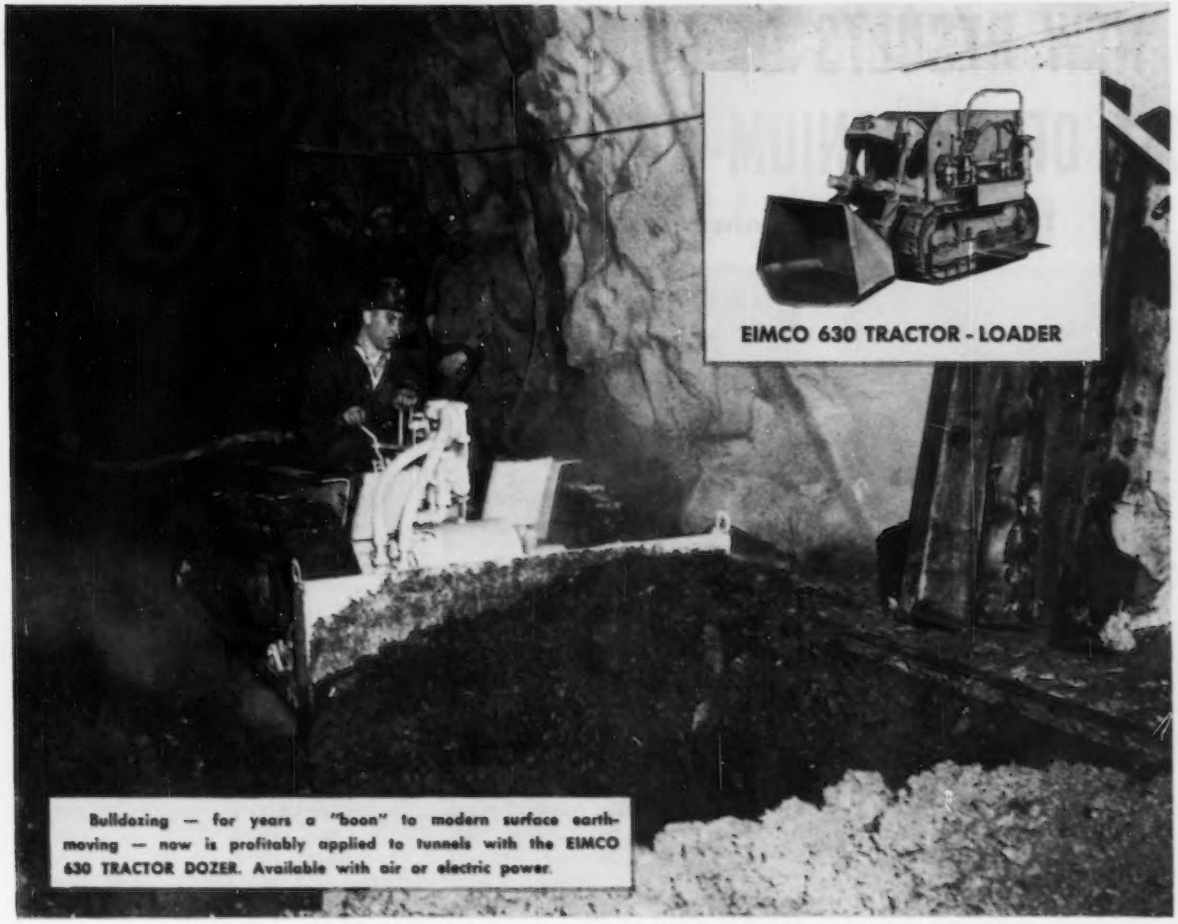
EIMCO 630 TRACTOR - LOADER
Bulldozing — for years a "boon" to modern surface earth-moving — now is profitably applied to tunnels with the EIMCO 630 TRACTOR DOZER. Available with air or electric power.

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The Eimco 630 Tractor-Dozer provides bulldozer earthmoving advantages, underground. It's a heavy-duty crawler . . . sized to work in low headroom; designed to operate fast and easy in tight spots; powered to provide ample "push" for moving tough materials.

The Eimco provides "on the spot" mobility . . . no time-killing preparations. It's a constant, reliable producer that moves more tonnage, faster . . . cheaper. The Dozer permits easy selection of high and low grade ores or waste. It removes material around pillars fast and easy with no extra provisions. It works where a slusher cannot be rigged.

Eimco 630 Dozers are pushing material to raises from low headroom, flat headed stopes; leveling blasted muck at headings; cleaning various types of inverts; grading, and producing in many other ways.

If your needs call for a fast loader . . . the EIMCO 630 Excavator (inset) is your answer. Tremendous crowd, extraordinary digging action, overhead discharge and easy operation speed up handling of heavy, hard-to-dig materials. And . . . it has front-end versatility for handling scores of other jobs, economically . . . from roof bolting to drill mounting.

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B-299

NEW RESULTS OF MONSANTO RESEARCH IN USE OF AMMONIUM NITRATE AS AN EXPLOSIVE

Typical shot with Monsanto's new kind of prilled NH_4NO_3

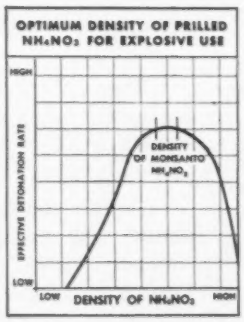
View of area involved in the blast. Shot was made in heavy columnar basalt at dam site. Used as an explosive: a new, top-quality, prilled NH_4NO_3 that Monsanto research developed to give you optimum savings, safety, speed and ease of handling.

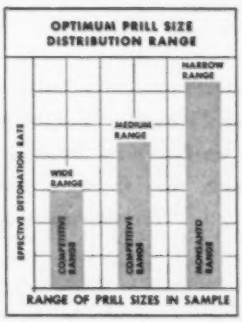
View at time of detonation. The system of detonation recommended by Monsanto, in conjunction with Monsanto Ammonium Nitrate, will yield equivalent pound-for-pound results with 60% gelatin dynamite at one-fourth the cost.

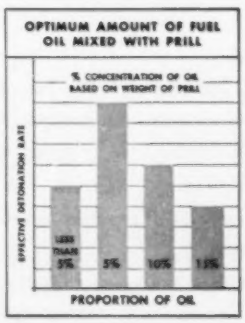
Results of blast. The powder factor in the shot above was 0.4 lbs. per cubic yard. Breakage of rock was considered ideal by contractor. Monsanto's experienced staff can give you complete technical service. Just phone Monsanto.

Photos courtesy of MORRISON-KNUDSEN COMPANY, INC.

Monsanto Ammonium Nitrate is now produced according to the specifications determined by these findings of Monsanto research. Result: more effective blast at greater savings. Monsanto is the world's largest manufacturer of prilled ammonium nitrate—and leader in developing the use of NH_4NO_3 as an explosive for open work. Request report presenting latest research findings.







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ENGINEER'S FIELD REPORT

PRODUCT: CHEVRON PRESSURE PRIMER SYSTEM

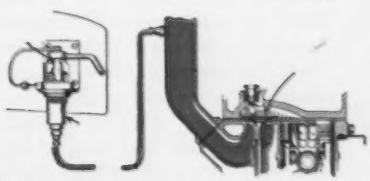
FIRM: JONES-TOMKINS CO. Cougar, Washington

Special cartridge fires giant diesel in seconds

At world's highest earth-filled dam construction site near Woodland, Washington, three giant diesel shovels get immediate starts from Chevron Pressure Primer System, reports Jones-Tomkins, general contractors. System helps speed shovel's fill-borrowing operations for this $51,000,000 project. Five-year-old 4500 Manitowoc Speed Crane (above), powered by Caterpillar 350 h.p. V-12 D397 engine, operates 18 hours a day, six days a week, loading 21-yard dump trucks in just 70 seconds. Jones-Tomkins uses Standard fuels and lubricants exclusively on this job.

Chevron Pressure Primer Discharger mounted on instrument panel (left) operates satisfactorily despite heavy vibration, reports shovel foreman Henry Watson (right). "We've had absolutely no trouble with this system. The Chevron Pressure Primer System eliminates dust clogging and allows fluid to reach the cylinders quickly. It's the practical way we've found to get these rigs going."

Why Chevron Pressure Primer System assures fast starts



- Volatile Chevron Priming Fuel atomizes in induction system at all temperatures even at −65°F, no hand-pumping required.
- Pressure or weakest spark from engine fires mixture.
- Simple rugged air-tight discharger prevents Priming Fuel leakage.
- Small, fireproof, pressurized steel cartridges protect Priming Fuel from water and dirt.

For More Information or the name of your nearest distributor, write or call any of the companies listed.

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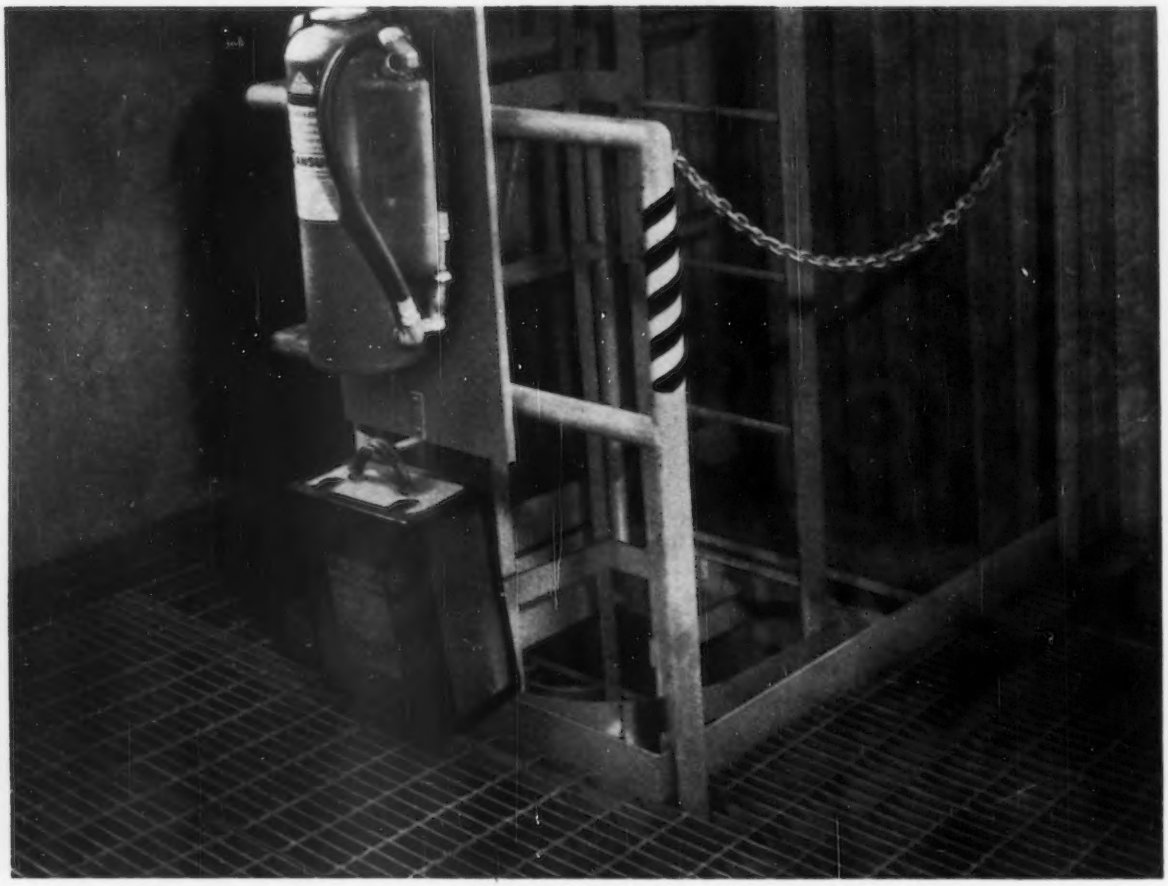

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Here's a plant that's out to keep "employee downtime" at a minimum. Extinguishers and gas masks provide protection against fire and toxic fumes. Guard rails and chains surround permanent hazards. Raised steel strips around floor openings prevent objects rolling or being kicked to the floor below. Clean windows and bright lighting provide good visibility. It's only natural that a company so interested in safety should select Blaw-Knox Electroforged® Steel Grating for "underfoot" safety.

Each section of Blaw-Knox Steel Grating is of rigid, one-piece construction. Choice of cross bar and bearing bar designs and spacings affords maximum safety under all working conditions. Indoors or out, you get safe, quiet, long lasting and self-cleaning flooring with maximum passage of light and air.

Blaw-Knox Electroforged Steel Grating is fabricated in a wide selection of materials to exact customer specifications. Fits easily and neatly into even the most congested areas.

Send for new Blaw-Knox Grating Catalog 2527. See new ideas in flooring, walkways, stair treads, platforms, shelving. Write today.

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Blaw-Knox Equipment Division · Dept. S, Pittsburgh 38, Pa.

familiar names

...in a new combination

A new name in metals—American Metal Climax, Inc.—arises from the merger of two well-known companies, The American Metal Company, Ltd. and Climax Molybdenum Company.

American Metal Climax, Inc. now offers expanded facilities and services. Its activities include mining, smelting, refining, marketing, exploration and research. Its products are molybdenum in all forms, potash, copper, lead, zinc, uranium, vanadium, tungsten, tin, solder, metal powders, precious and rare metals, selenium, germanium, tellurium, cadmium, cobalt, bismuth, arsenic, oil and gas, and others. Its interests circle the globe; principal business activities are in North America, Western Europe, and Africa.

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Climax Molybdenum Company—a Division
500 Fifth Avenue, New York 36, New York

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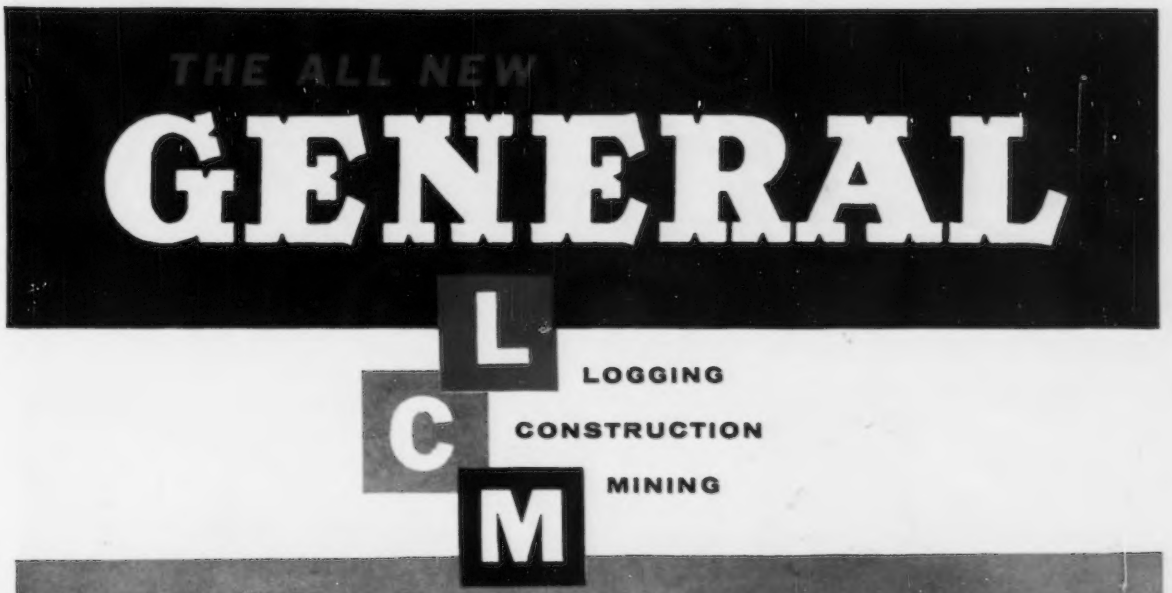
Toughest....Strongest

Specify Generals on your new equipment

THE GENERAL TRUCK TIRE

Tire Ever Built!



No matter what the job, weather, or terrain, this big husky new General LCM is your assurance of dependable, profitable all-round performance.

Featuring the amazing strength of Nygen cord plus a wider and heavier tread, this great new LCM gives you flotation and traction beyond all comparison.

Choose your toughest job and then choose the dependable, deep-bite performance of the all new General LCM.

THE GENERAL TIRE & RUBBER COMPANY

Akron, Ohio

In rotary drilling, pulling a 100-ton, two-mile string of drill pipe subjects the drilling line to the terrific stresses imposed by fast acceleration, shock loads, bending and overwinding on drums. Only wire rope with the highest degree of quality in hardness, strength and fatigue resistance can be used, for toolpushers know that . . .

A quality rope is a safe rope

Whether you use wire rope in the field or in a factory, *safety is just as important to you.* When you buy "bargain" rope you bargain with safety. It can cost you more than the pennies you save. Buy on the basis of *quality*—buy Wickwire Rope.

For extra strength—buy Wickwire's Double Gray IWRC extra improved plow steel wire rope

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PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

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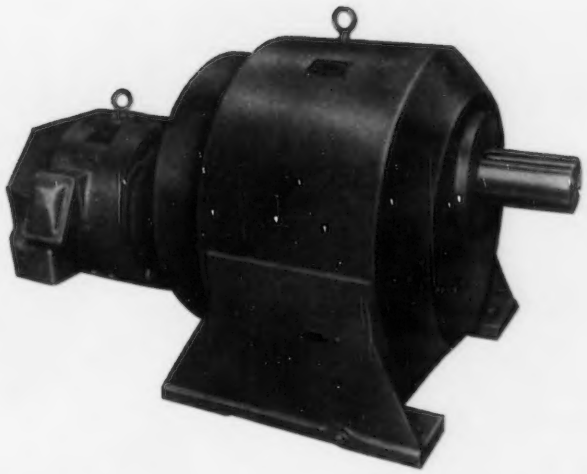

NOW . . . GREATER CAPACITY than any other standard gearmotor . . . and in smaller space!

Capacity up to 200 hp loads, with ratios up to 440:1—that's what you get with the new Philadelphia Type "G" Gearmotor. No other standard gearmotor or in-line reducer on the market offers such high capacity and rugged construction. Yet its compact design gives you the smallest possible power package for any job. The Type "G" is the answer for any application demanding heavy duty, continuous service performance.

Compact Design. "Shaft-in-line" design makes the new Type "G" Gearmotor more compact and permits complete flexibility in mounting.
Result: substantial savings in space required. You can even mount the Type "G" without a base plate.

Helical Gearing supports larger loads with maximum power efficiency (96-98%)—assures silent operation, increased strength, longer life. Teeth are crown shaved and induction hardened for optimum performance.

The Type "G" Gearmotor is an extension of the famous Philadelphia Gearmotor Line. It is available as a reducer, gearmotor with motor mounting bracket, or standard gearmotor with flange mounted motor. For complete information, write for Bulletin GM-57-B, Philadelphia Gear Works, Erie Ave. and G Street, Philadelphia 34, Pa.

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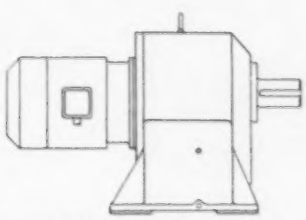
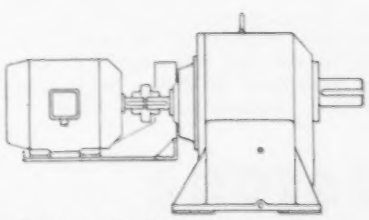
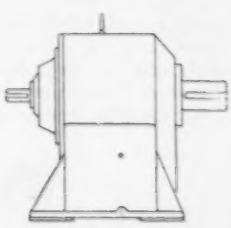


INTEGRAL GEARMOTOR (Flange Motor)



UTILITY GEARMOTOR (Foot Mounted Motor)



IN-LINE REDUCER

BIG PROJECTS PROVE IT!

Firestones are carrying more loads per dollar!

From the St. Lawrence Seaway to the Priest Rapids Dam in the State of Washington, records prove that Firestone Rock Grip Tires with S/F—safety-fortified—Nylon outwork and outwear them all. Tough cord bodies withstand severest punishment to slash downtime losses. You cut tire costs because two great tread designs match these off-the-highway tires to *any* job. You get the *flotation and traction* you need in loose earth and wet going. You get *armored* protection for hauls over splintered shale and knife-edged rocks. Firestone Tires defy cuts and slugging impacts like no other tires made. Ask your Firestone Sales Engineer about these *tubed* or *tubeless* heavy-duty tires. Call him today at your local Firestone Dealer or Store.

ROCK GRIP WIDE BASE ROCK GRIP

Firestone

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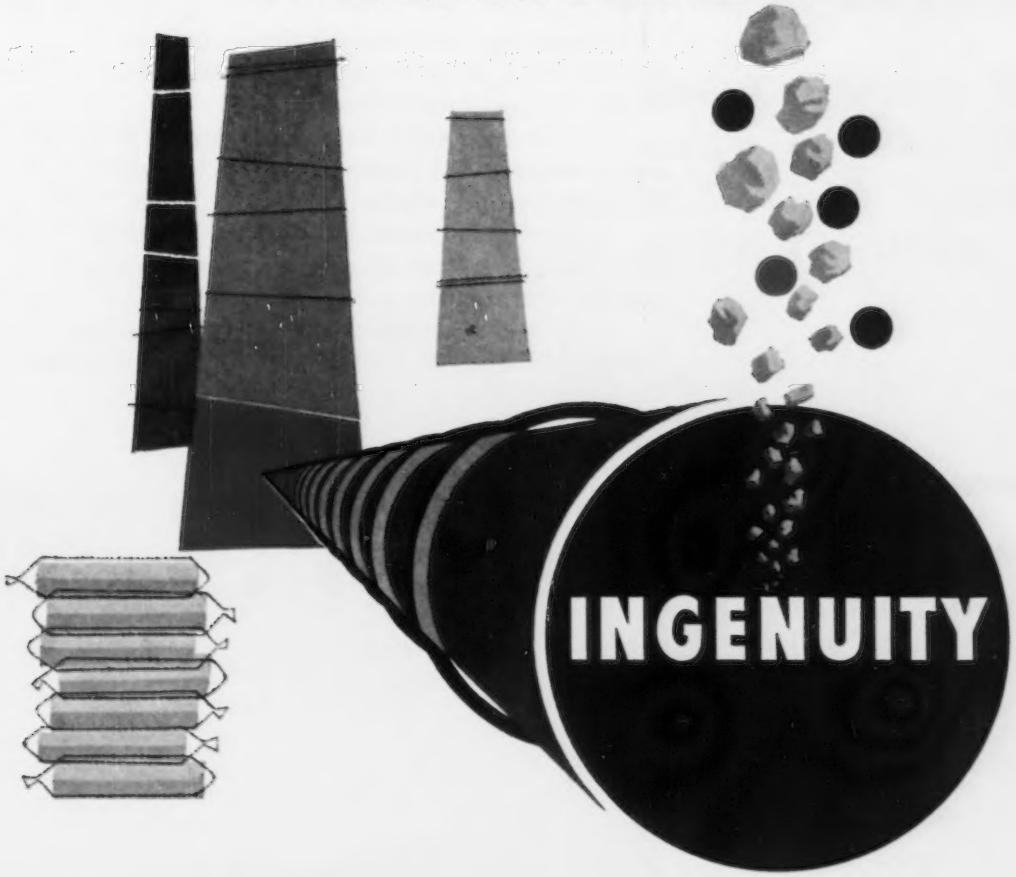
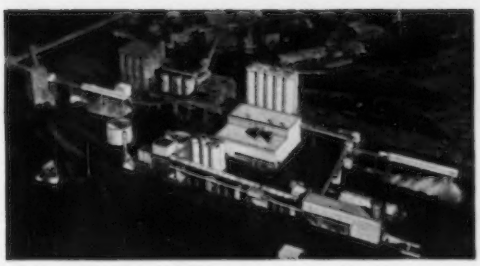
call KE for plant expansion or new facilities





1,250,000 barrel cement plant addition recently completed by KE for Marquette Cement, one of world's largest cement producers.

has made KE a major engineer-contractor serving the Minerals Industry

Placing of four fully-lined mills in a few hours instead of days—a unique center pier kiln drive —a 2,700′ cement transport "airway." With these and many more planned innovations and short-cuts, Kaiser Engineers completed Marquette Cement's Cape Girardeau plant expansion quickly and economically. Construction cost and time were well below industry average.

Mining, transportation, beneficiation, materials handling, processing in cement, gypsum, coal, ferrous and non-ferrous metals facilities—these are but a few of the fields wherein KE serves the Minerals Industries—from economic analysis through start-up.

KE ingenuity—multi-industry experience, keenly applied—can benefit your next facility. Let us show you how.

KAISER ENGINEERS

engineers—contractors
Contracting since 1914

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This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

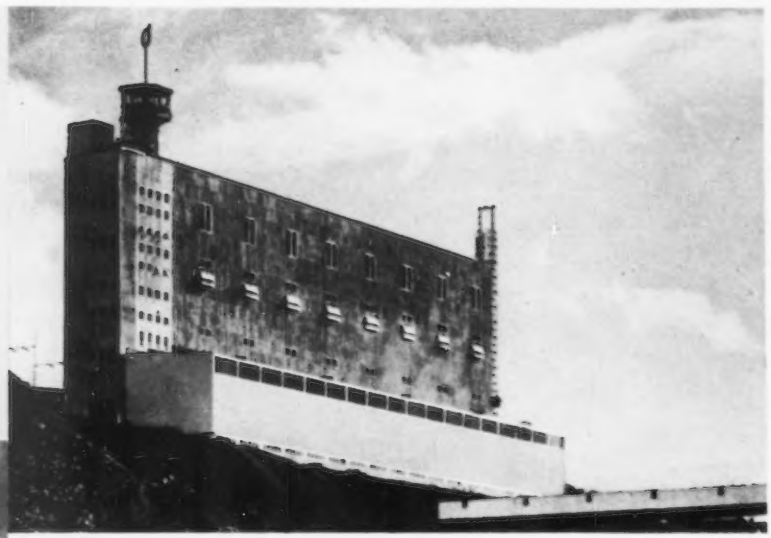
Each of these ASEA Hoists has a skipload of 22 tons and is designed for a depth of 1500 feet, maximum speed 2200 feet per minute.

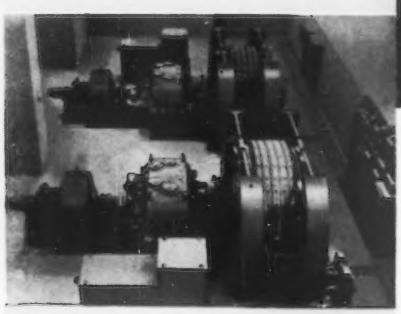
At Kiruna, as in mining operations throughout the world, ASEA Multi-Rope Hoists prove less costly to operate, safer, and they reduce rope wear.

In the U.S. these advantages may be seen in the ASEA installations of National Potash Co. and Cleveland Cliffs Iron Ore Co.

9 HOISTS IN ONE HEAD FRAME

Total capacity: 4600 tons per hour





FULLY AUTOMATIC, the ASEA Hoists at Kiruna eliminate the employment of hoist men. At U.S. wage rates, assuming two-shift operation, this would mean a saving of about $30,000 yearly for each hoist!

Write for illustrated literature on ASEA Multi-Rope Friction-Drive Mine Hoists.

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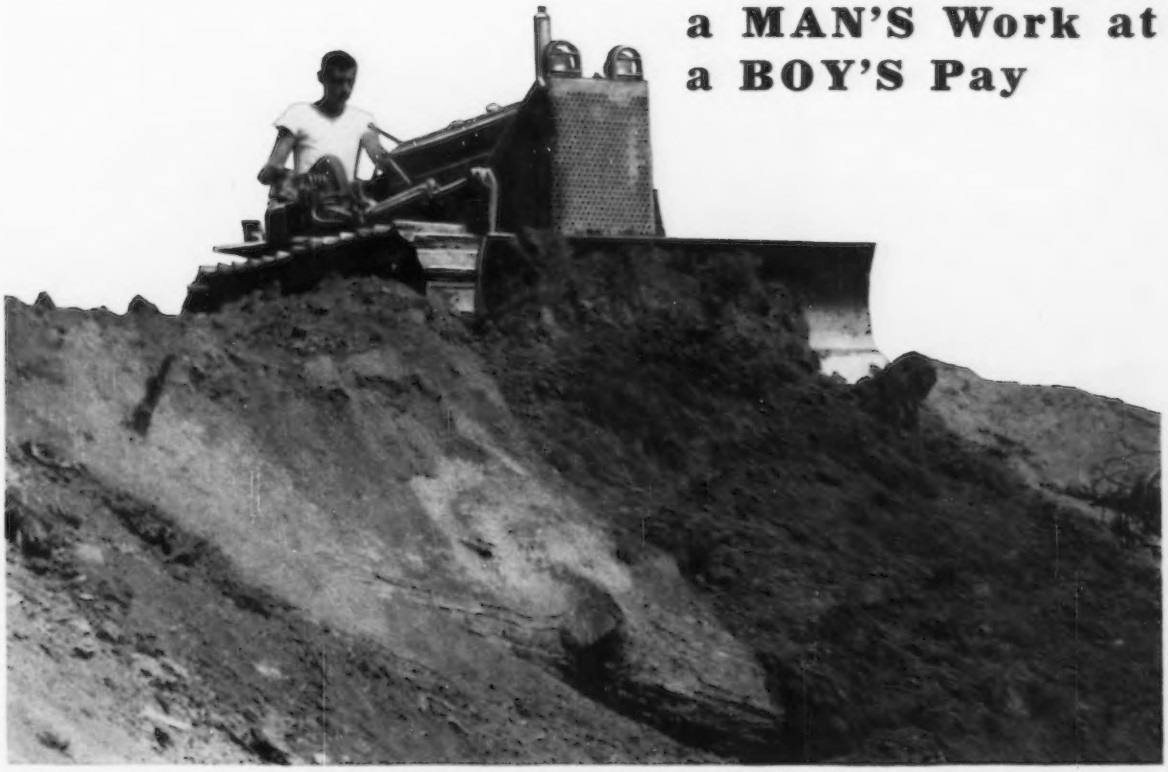
ASEA equipment is sold and serviced in the U. S. by:

AROS ELECTRIC, INC.

500 FIFTH AVENUE, NEW YORK 36, N. Y.

IT'S A JOHN DEERE!

. . . the Ruggedly Built Crawler That Does a MAN'S Work at a BOY'S Pay



WHEN you're figuring costs, how many times have you wished for a rugged, compact, inexpensive power unit that would turn in a really BIG day's work at costs far below tractors you may now be using?

Very likely, the John Deere Crawler is exactly what you've been wanting.

First, make no mistake about its ability to do a man-sized job. On contracting jobs of all kinds, on materials-handling work, you simply have to *see* the amount of work—and the quality of work—this high-torque, sure-footed crawler is turning out.

Here is rugged power to push or pull unbelievable loads; power to replace bigger, more costly tractors on many jobs.

Here is a tractor with multi-purpose equipment so adaptable there is almost no end to its uses . . . a tractor that's easy to transport, easy to handle, comfortable to ride, a compact, highly maneuverable tractor that gets in and out of tight places.

Best of all, it is economical any way you look at it. Initial cost? The investment is well within the range of the small-scale home-builder. A set of tracks for some tractors costs more than a complete "420" Crawler. Daily fuel costs? Fill the 10-1/2-gallon gas tank and you're all set for a full day's work. Maintenance? The name John Deere assures you the high quality of materials and workmanship that has been traditional with John Deere products for more than 120 years.

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KENNEDY *11'-6" Dia. x 14' Ball Mill for grinding iron ore.*

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New Chemical Tools for Ore Processing From Cyanamid's Research Laboratories

Have You Evaluated These New Products?

At Cyanamid's Stamford, Connecticut Research Laboratories a task force of almost 1,000 people is continually striving to develop new products and application methods for our chemical consumers. The Mining Chemicals research staff is part of this group. Listed here are some products currently available as a result of their efforts. It may be profitable to evaluate these new reagents, if you have not already done so.

AERO® Promoter 765 – Readily emulsifiable fatty acid promoter, particularly effective in low-temperature pulps. Ease of emulsification and feeding improves performance and collecting efficiency; often effective at lower dosages than regular fatty acid. Commercial quantities available.

CYQUEST 40® Sequestering Agent – Chelating agent which complexes bivalent and trivalent cations. Useful as modifier in oxide flotation. Commercial quantities available.

Reagent S-3107 – Acid-circuit copper promoter. Available in research quantities only.

Reagent S-3135 – Acid-circuit copper promoter. Bulk sulfide promoter. Available in commercial quantities.

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Reagent S-3160 – Low molecular weight, water soluble, synthetic polymer. Functions as slime dispersant, sequestrant and flotation modifier. Especially effective in cyanidation to prevent lime scale formation. Pilot-plant quantities available.

Reagent S-3185 – Fungicide, bactericide, algaecide—may be used for preventing mold and bacteria growth in tailings ponds, water reservoirs, ion-exchange systems, etc. Also acts as promoter for certain silicates and HgS. Pilot-plant quantities available.

Reagent S-3193 – Low molecular weight, water-soluble synthetic polymer with same possible applications as S-3160. Available in research quantities only.

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UNDERGROUND DUMP TRUCK

FOR STANDARD HEAD ROOM AND DRIFT AREAS . . .

The Oremaster, a rugged, heavy duty unit, was developed for metal mines with the cooperation of one of the largest mining companies in the midwest.

Having a low height over the side of the dump body permits the use of loaders that cannot be used with conventional height trucks and enables loading over the side or from the end.

The Oremaster has three speeds in either direction (two for loaded use), enabling the heading to be worked without turning the truck around. It is no problem to back into the heading with this unit.

Write for complete details.

ORTRUC MFG. DIVISION
ORTRUC INC., MT. CARMEL, ILL.
REPLY: 320 South Grand, St. Louis 3, Missouri

SPECIFICATIONS

ENGINE — GM Diesel Engine, Model 4-71-4058C

TRANSMISSION—Allison—CT 3340—4 speed
Lubrication: Type-Full Pressure Capacity—7.50 Gal.

TORQUE CONVERTER: Allison—TC 420 Single Polyphase 3.00-1 Ratio 4-Element
Built-in braking features with Drive line parking brake with brake lock.

CLUTCH: Multiple Disc Type; sintered bronze —Steel core Hydraulic actuated — Automatic wear compensation

COOLING SYSTEM: 7½ gallon capacity — Harrison fin and tube type construction

TIRES: Nylon Rock Grip Excavator—10.00 x 20—14 Ply

BRAKES—Air
Size—16¼" x 3" x ⅜"
Type—Timken DPA

SPRINGS—
Length—49 inches
Width—3 inches
Number of leaves—10
Shackle bushings—Bronze
Capacity per springs—5,500 lbs.

STEERING GEAR—Ross TA71
Type—Roller-bearing cam and twin-lever

DIMENSIONS:	feet	inches
Wheelbase		145"
Turning Radius—right	23'	
(Area to turn 180°—40'x40') left	25'	6"
Over-all Length	20'	0"
Over-all width	8'	2½"
Over-all height over highest body point	7'	0"
Loading height (Top of body from ground)	6'	5½"
Wheels and body removed: Length	19"	
Width	7"	
Height	5"	
Length of body—inside top		119"
over-all		132½"
Width of body—inside top		92"
over-all		98⅛"
Depth of body—inside front	1'	7"
Road Clearance—minimum		8"
Height of body in dumping position	12'	3½"

SPEED: MPH, loaded
Forward: 4.5—1st; 7.5—2nd; 25.4—3rd
Reverse: 3.4—1st; 5.0—2nd
Maximum speed on a fifteen per cent grade with heaped truck load 5-7 MPH (Maximum recommended for underground)

BODY CAPACITY:
10 Tons—Partial Heaped Load

HOIST—2 Anthony—6" Telescopic, 15 Ton Capacity Weights

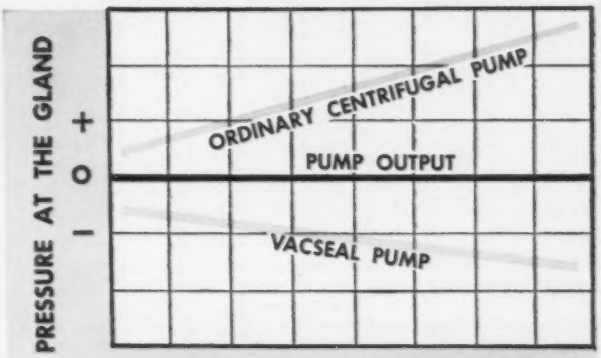
	Pounds
Truck Chassis—All Equip	12,300
Body	4,500
Total Weight	16,800

F.O.B. Shipping point—St. Louis, Missouri
90 day warranty on all parts with exception of Engine and Transmission which carry manufacturer's standard warranty.

VACSEAL PUMP

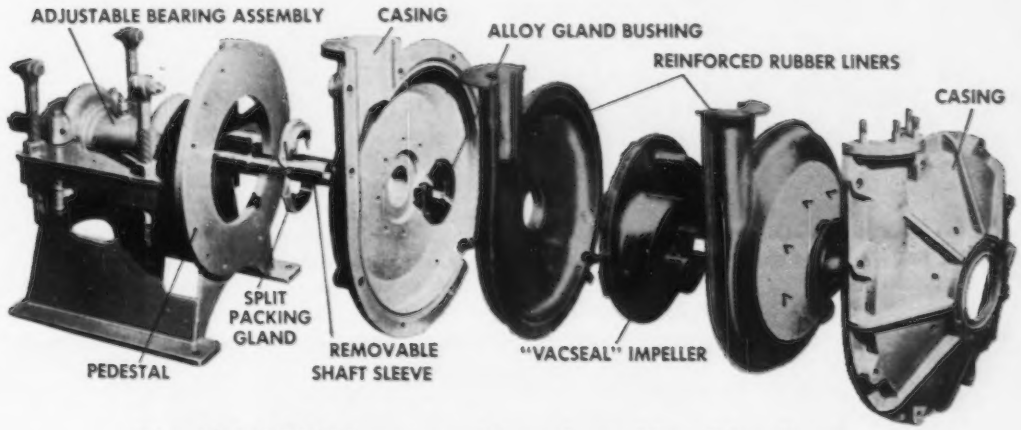
"The harder it pumps the better it seals"

VACSEAL supremacy rests on the *original* VACSEAL impeller design that eliminates leakage at the pump gland. The harder it works the tighter it seals—while the conventional centrifugal pump shows pressure build-up at the gland with increase of speed. Because of this advanced pump design, materials being pumped do not come in contact with the packing or the shaft sleeve. Result – no leakage and greatly reduced shaft wear! The rugged VACSEAL handles all types of material, including: abrasive pulps, acid and corrosive solutions, tailings, semi-solids and many other difficult to handle materials.



When VACSEAL PUMP is operating the pressure on the gland is less than atmospheric pressure.

VACSEAL PUMPS are available in many models, including: fixed or replaceable, metal reinforced, rubber linings and all alloy types and in sizes ranging from 1½" to 8". Write for additional data and performance records on these pumps. No obligation.



4" x 6" VACSEAL pump with replaceable rubber liners.

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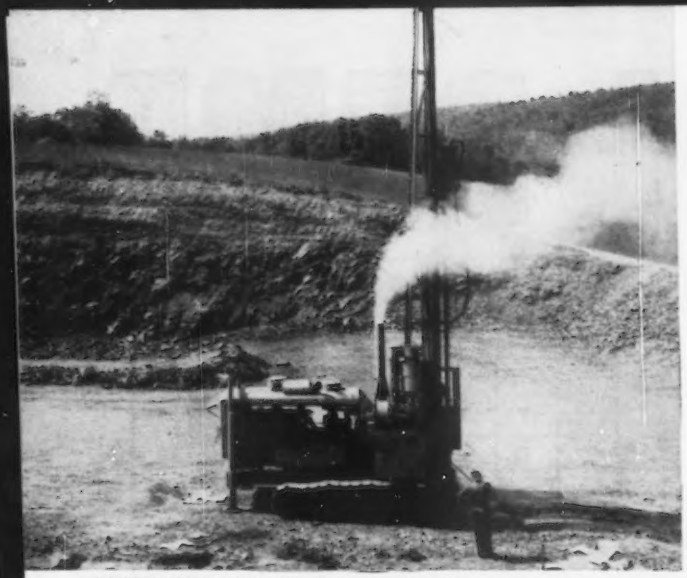

DRILLMASTER. If it's big holes you're after, on a real production basis, you can't buy a more productive drilling machine than the I-R Drillmaster.

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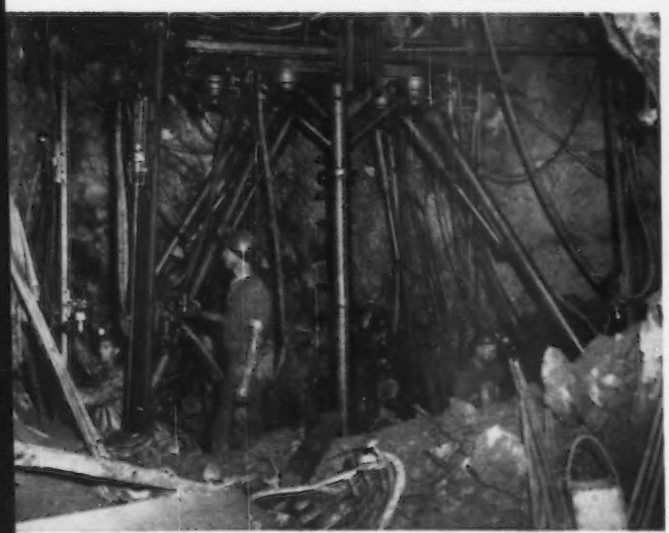

SHAFT JUMBOS. I-R Hydra-Boom Shaft Jumbos save set-up time, drilling time, manpower.

SEND FOR BULLETIN NO. 4188

CRAWL-IR. Here in one rugged package is self-propelled crawler drill with *all* boom and feed-tower adjustments controlled hydraulically.

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UNIVERSAL JACKDRILL. The easiest-handling one man universal drilling unit ever developed; converts quickly to Stoper or Jackhamer.

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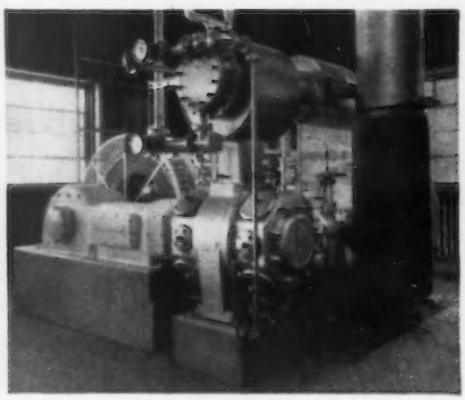

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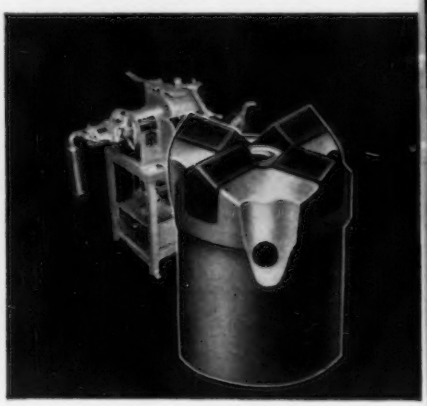

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A CONSTANT STANDARD OF QUALITY
in everything you need for drilling rock

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HYDRA-BOOMS. Available with extendable and non-extendable features and with hydraulic power cone, dump and swing.

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WAGON DRILLS . . . the "workhorses" of rock drilling. Available in two drill mountings: Heavy-duty FM-4 and lightweight "wagonjack."

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SHORT-LEG STOPER. Lightweight and easy to handle, the I-R Short-Leg Stoper is designed *specifically* for low-cost rock bolting.

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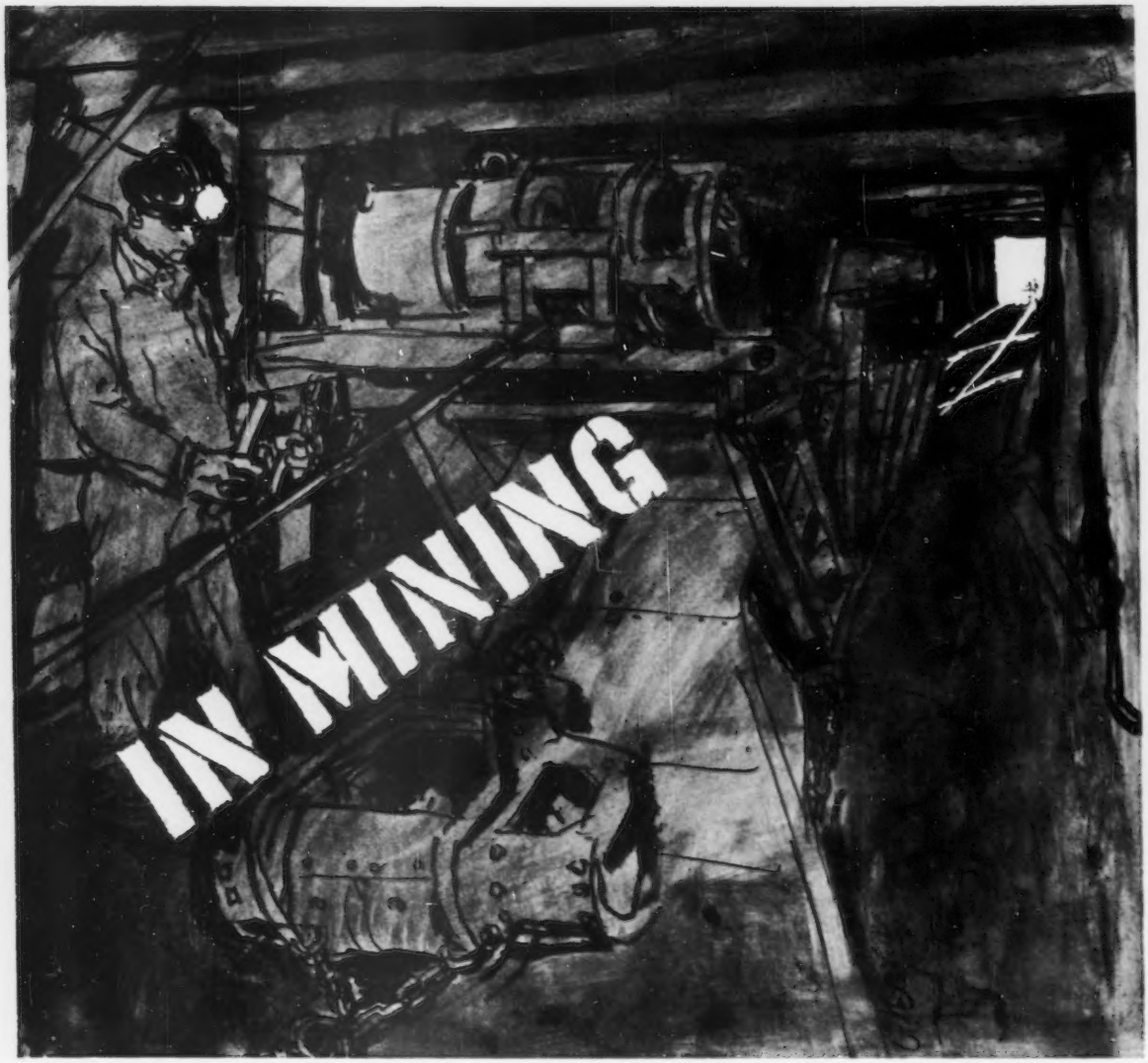

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DESIGN
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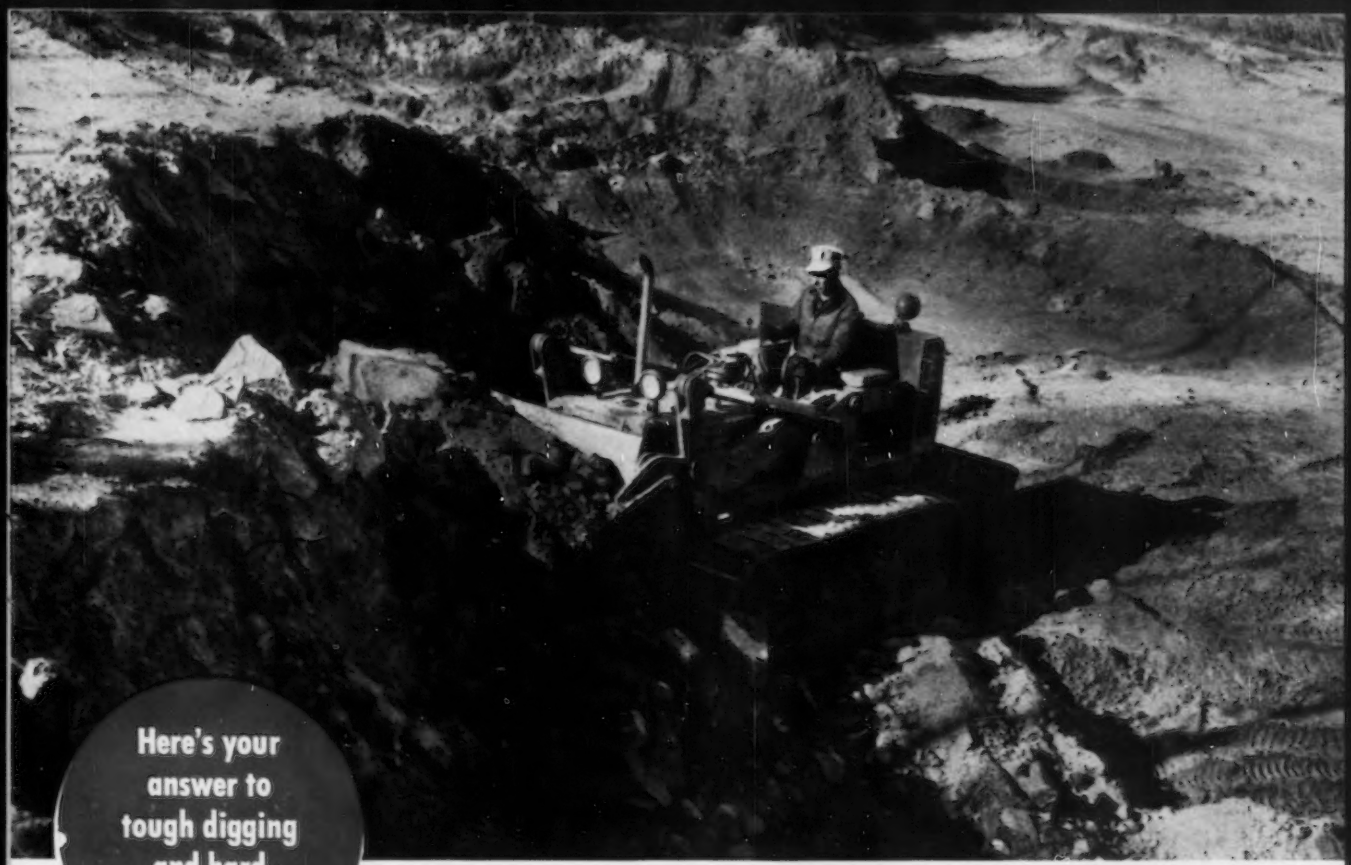

Here's your answer to tough digging and hard loading!

Doubling for dynamite, this 4-In-1 is digging and loading "unshot" sandstone material for binder and fill. Holland and Woodward Stone-Gravel Trucking Co., Decatur, Alabama, reports this material formerly had to be "shot"—before previously-used equipment could handle it!

Multiply your job range.... by FOUR
Divide your rig investment by FOUR!

Instead of sinking your capital in an old-fashioned "single-action" loader, let the same money buy four big-capacity International Drott 4-In-1 machine actions!

Instead of allowing profits to dwindle because an ordinary tractor-loader can't do 'dozer, scraper, or clam-shell work, change to a 4-In-1! Move the machine-selector lever, right from the comfortable foam rubber seat, and watch your profit-building potential go up and up!

You aren't getting just "another bucket"—but famous and exclusive Skid-Shovel® rock-busting, pry-action break-out. And 41° bucket-heaping, ground-level roll-back. It's the one and only true pry-action! That means full hydraulic power transfer—correct pry-lever length—and exclusive frame-mounted skid-shoes to provide the vital fixed fulcrum!

And you're also getting easily-controlled, earth-rolling bulldozer action. Plus "carry-type scraper" action to grade, strip, or spread with inch-close accuracy. Plus super-speedy clamshell action, with bottom-dumping to eliminate the sticky materials problem. Plus the exclusive performance protection of shock-swallowing Hydro-Spring!

Invest only 15 boulder-bucking, earth-rolling, load-gulping, sod-stripping minutes! Prove to yourself that an International Drott 4-In-1 multiplies your job range, and divides your investment, by four! Prove you can't afford to handicap your future with any limited-duty rig—when you command this versatility unlimited. See your International Drott Distributor for a 4-In-1 demonstration.

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INTERNATIONAL® DROTT®

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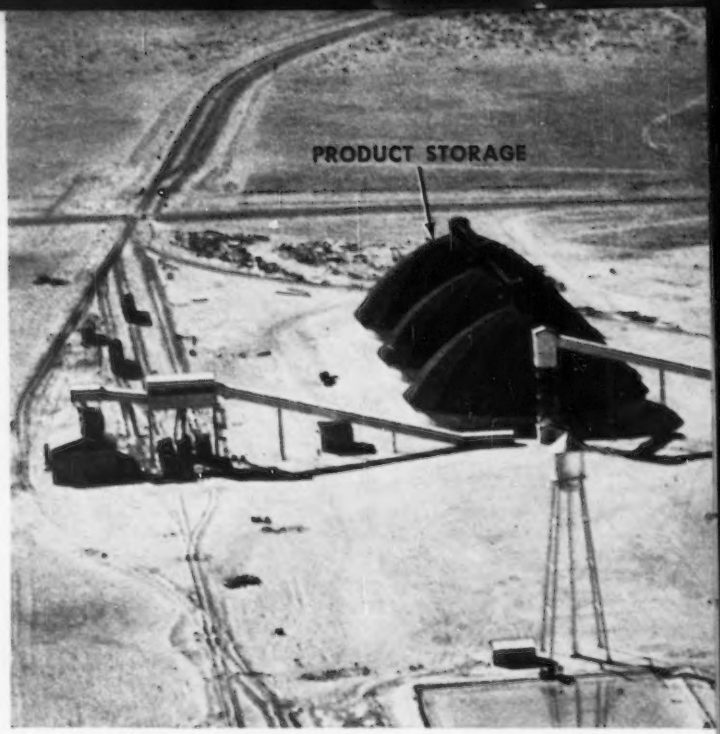
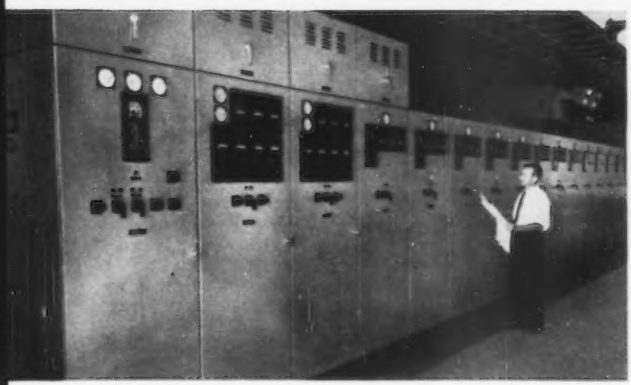
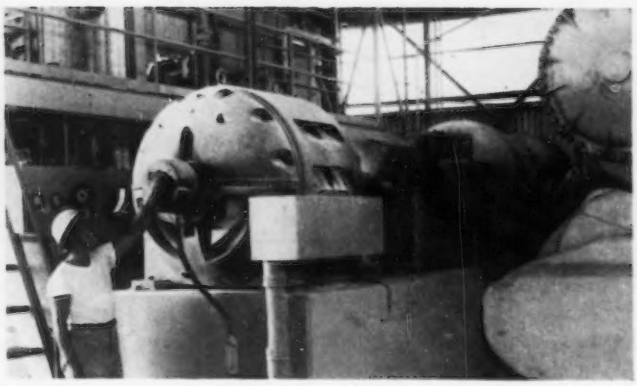


Highly electrified

PLANNING electrical system are (l. to r.) G. R. Yelderman of G.E., D. A. Haley, National Potash electrical engineer, R. W. Jenkins, former underground supt.

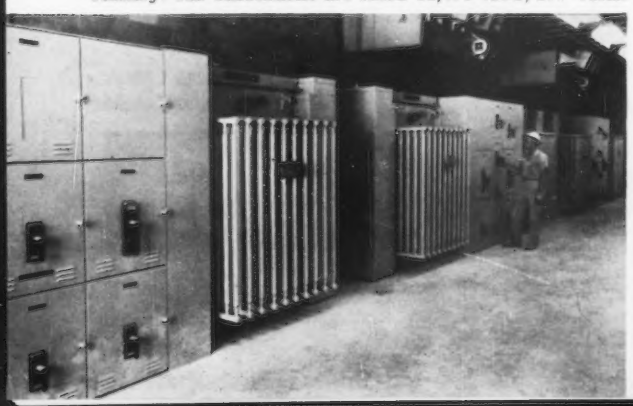


ENTERING bank of space-saving G-E metal-clad switchgear in substation #1 is incoming 12,470-v power. This economical high voltage is distributed to entire mine and refinery.

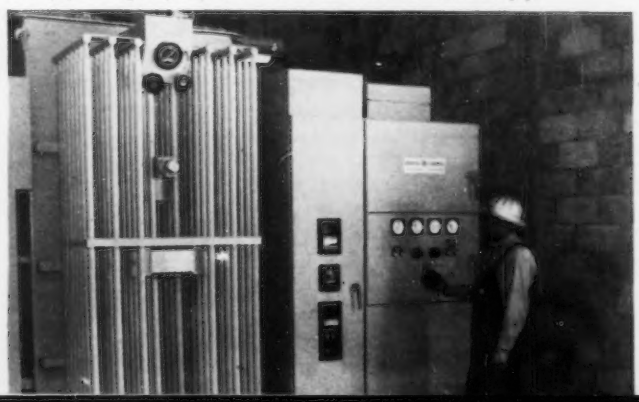


DRIVING refrigeration compressors, utilized in the refining process, is a dependable G-E 1250-hp 4160-v synchronous motor, carefully protected by electrical safety devices.

SUPPLYING full-voltage power for 174 refinery motors (¼ to 200 hp) are three G-E load-center unit substations in refinery. All substations are rated 12,470-480Y/277 volts.



SERVING as starter, protection for 1250-hp motor driving refinery refrigeration system is high-voltage Limitamp* control (r.) fed by 12,470/4160-v G-E medium transformer (l.).



PRODUCTION FLOW at new mine is via conveyor from (r. to l.) initial ore storage to crushing, refining, and product storage.

National Potash mine producing 3000 tons/day

MIXING of crude ore with saturated brine and reagents, prior to flotation, is powered by corrosion-resistant, cast-iron TEFC, Tri-Clad* 55 motors.

CONTROLLING low-voltage refinery motors is G-E motor-control center. Grouping of motor controls saves space, eases installation, maintenance.

General Electric services, equipment help provide maximum shut-down protection, lower power-distribution costs

Newest mine in the vast potash-rich area of southeast New Mexico is the multi-million dollar project of National Potash Company. Now producing at a rate of 3000 tpd, its smooth flow of production is aided by modern, G-E system-engineered electrical equipment. General Electric engineers and The Stearns-Roger Mfg. Co. of Denver, engineers and constructors of the plant, worked with National Potash to design and install a system which incorporates safe, flexible, economical distribution and utilization of electric power.

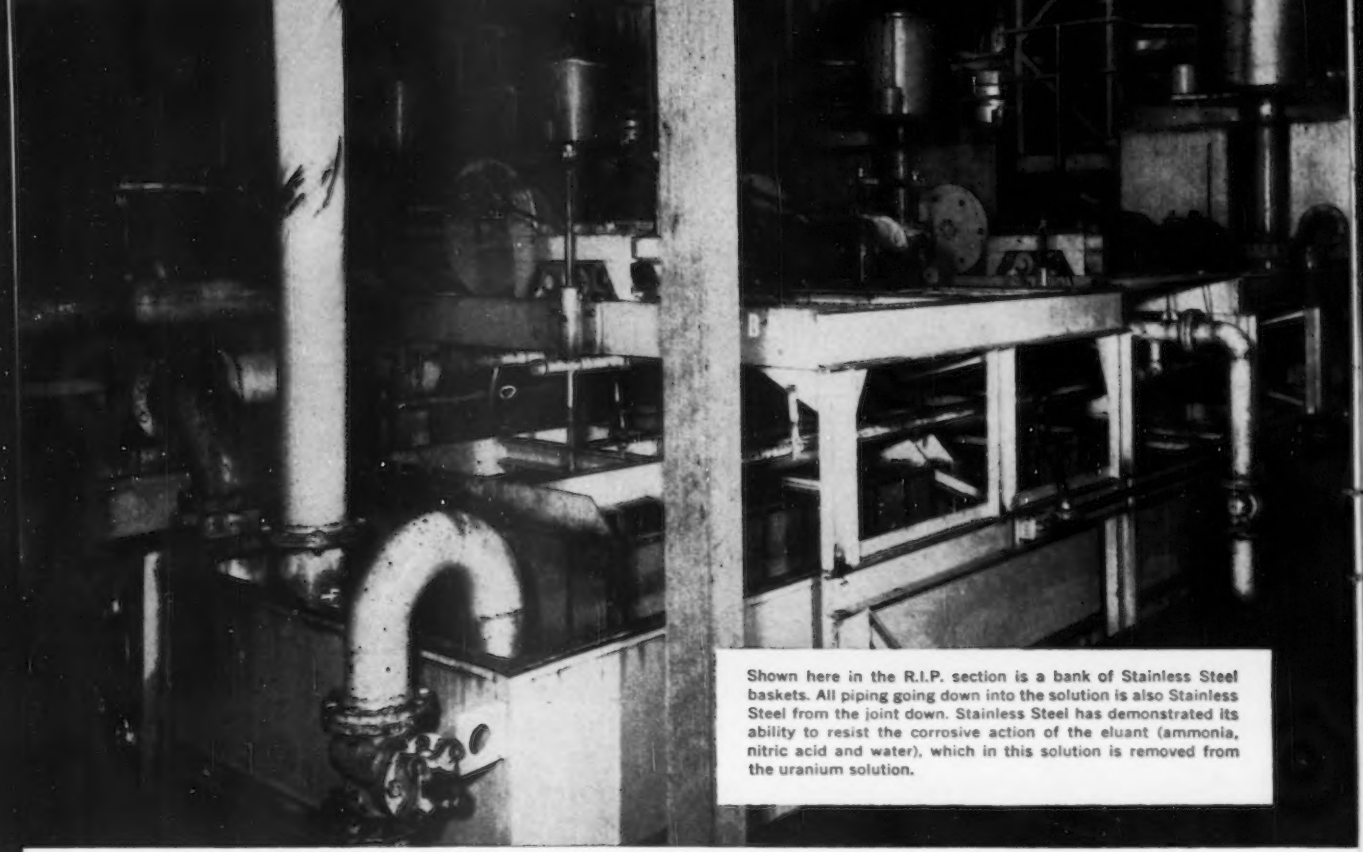
THIS INTEGRATED SYSTEM features the use of the primary 12 kv as an economical distribution voltage as well—even carries it 1700 feet underground. Major plant electrical equipment receives better grounding protection through a plant-wide grounding loop terminating in a 300-ft water well. Electrical interlocking for the entire plant motor system provides equipment protection by shutting down all necessary equipment in the event of outages at any point.

YOU CAN BENEFIT, too, from the help of G-E engineering services. Before you expand or modernize, contact your nearest General Electric Apparatus Sales Office early in your system planning. General Electric Co., Schenectady 5, N. Y.

*Reg. trademark of General Electric Company. 660-38

Engineered Electrical Systems for the Mining Industry

GENERAL ELECTRIC



Shown here in the R.I.P. section is a bank of Stainless Steel baskets. All piping going down into the solution is also Stainless Steel from the joint down. Stainless Steel has demonstrated its ability to resist the corrosive action of the eluant (ammonia, nitric acid and water), which in this solution is removed from the uranium solution.

"Without Stainless Steel certain phases of this milling operation would have been impossible on a practical basis"... reports an official of Uranium Reduction Company, Moab, Utah

At the Uranium Reduction Company plant, uranium ore is custom-milled to a finished product assaying 75% U-308. To combat corrosive conditions occurring at various stages during the milling, Stainless Steel has proved the only practical material to use.

The ore is first crushed to minus two inches, then to minus one inch. It is next reduced to minus 28 mesh by wet grinding. The uranium in the ore is dissolved by treating the ore with sulphuric acid for approximately 16 hours. After this leaching process, the slurry is pumped to the de-sanding units where Stainless Steel finds one of its most extensive applications. Because of its unique resistance to corrosion, Stainless Steel is used for the large blades in the machines that separate sands from the fine particles. All exposed metal coming in contact with the acid mixture must be made of Stainless Steel to resist corrosive action.

From the de-sanding section, the uranium-bearing fine-mesh slurry is pumped into the R.I.P. (resin-in-pulp) section. Here the resin picks up the dissolved uranium and holds it while the waste material is pumped off. In this section are 28 banks, each bank containing four Stainless Steel woven wire baskets. All supporting angle irons, nuts, bolts, and piping which are immersed in the acid solution are made of Stainless Steel. Other acid-resistant materials do not have the properties to withstand the processing this product must undergo.

In summing up the reasons for using Stainless Steel so extensively, Uranium Reduction metallurgists state that "The use of Stainless Steel benefits processing because the R.I.P. section would be impossible to maintain without Stainless. If it were not for Stainless Steel, there would be no finished product."

United States Steel Corporation, Pittsburgh · American Steel & Wire Division, Cleveland · Columbia-Geneva Steel Division, San Francisco
National Tube Division, Pittsburgh · Tennessee Coal & Iron Division, Fairfield, Ala. · United States Steel Supply Division, Warehouse Distributors
United States Steel Export Company, New York

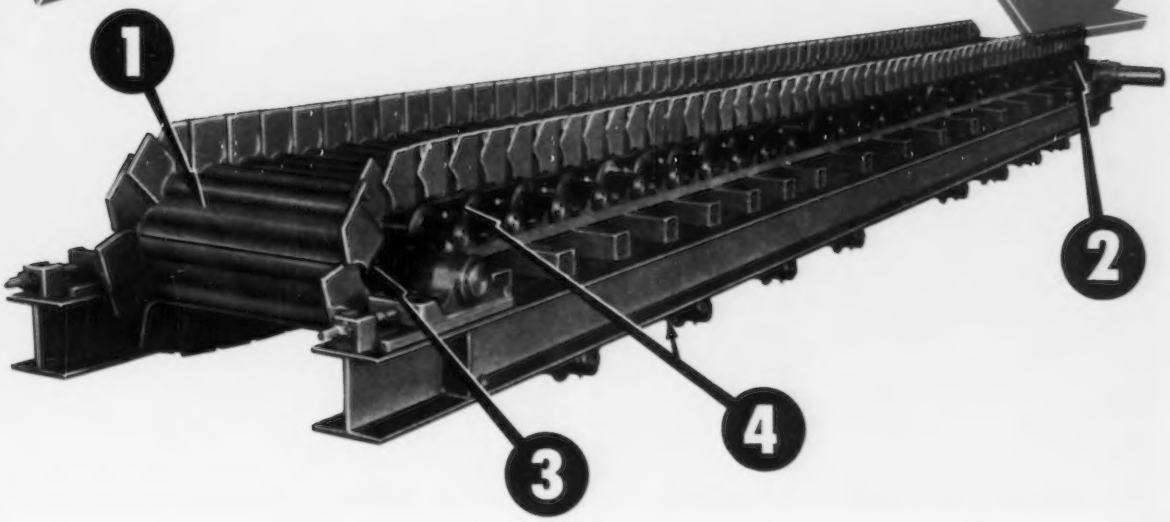
USS STAINLESS STEEL

Sheets · Strip · Plates · Bars · Billets · Pipe · Tubes · Wire · Special Sections

USS

UNITED STATES STEEL

WHERE WEAR COUNTS!



TISCO® PAN FEEDERS

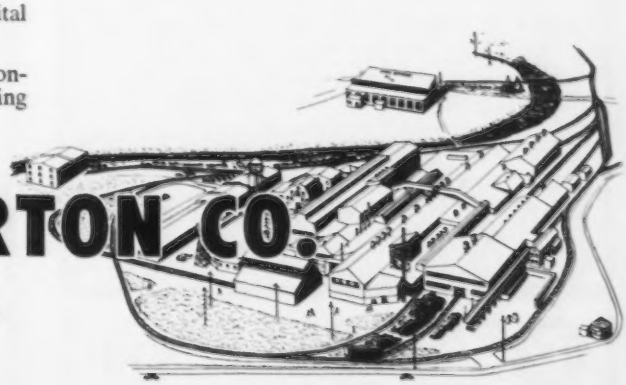
❶ **FEEDER PANS** — Hammered by tons of heavy rocks and ore every minute, but tough TISCO Manganese Chrome Steel pans lick impact and abrasion, outwear ordinary pan feeders 5 to 1.

❷ **HEAD SPROCKETS** — One break-down here flattens production. For dependable durability Manganese Steel does the job.

❸ **IDLERS** — Manganese Steel in this vital part keeps idlers busy, smooth running.

❹ **ROLLERS** — When each roller must continually shake off shocks and abrasion nothing wears like Manganese Steel.

Picture tons of heavy, abrasive material smashing down on this TAYLOR-WHARTON Pan Feeder, month after month without a breakdown. The reason — tough TISCO Manganese Steel soaks up shock and abrasion, keeps production climbing, maintenance down. For further information write to:



TAYLOR-WHARTON CO.

DIVISION OF HARSCO CORPORATION
Established 1742
HIGH BRIDGE 1, NEW JERSEY
PLANTS: Cincinnati, O. — Birmingham, Ala. — Easton, Pa.
SALES OFFICES: New York — Chicago — San Francisco

you DIG more

with BREAKOUT action

. . . and 40° bucket tip-back ***at ground level,*** both of which are productive features EXCLUSIVE with "PAYLOADER" tractor-shovels. They can not be found on any other rubber-tired loader.

To the user they mean that loads can be obtained easier and faster with less strain on the machine and bigger loads can be RETAINED in the bucket with the 40° tip-back AT GROUND LEVEL.

The FIRST four-wheel-drive tractor-shovels were introduced by The Frank G. Hough Company just ten years ago and many of them are still in daily use. Neither they, nor any of the numerous copies being offered are as productive as these new "PAYLOADER" models.

Every "PAYLOADER" distributor not only invites comparison but will be glad to PROVE in ACTUAL DEMONSTRATION all of the points of "PAYLOADER" superiority.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

11-B-1a

you CARRY more

with CUSHIONED loads

. . . using hydraulic load-shock absorber as standard equipment on all four-wheel-drive "PAYLOADER" models, another HOUGH EXCLUSIVE.

It doesn't matter what kind of an extra big load an operator was able to get to begin with if most of it is lost in SPILLAGE while traveling.

The "PAYLOADER" load-shock absorber does not completely eliminate spilling if you are operating over exceptionally rough surfaces . . . but it does minimize the loss and enable you to RETAIN more.

This is just one more reason why these new "PAYLOADER" tractor-shovels are more productive and why the combination of all the features which only Hough-designed units offer the user make "PAYLOADER" a better buy than any other equipment.

If you are not familiar with these new models your "PAYLOADER" distributor will be glad to demonstrate them to you.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

11-B-1b

you DELIVER more

with NO STOP for shifts

. . . which the "complete" power-shift transmission of these "PAYLOADER" units provides by saving time and effort.

There is no need to bring HOUGH tractor-shovels to a stop for a "range" shift. All shifts in both forward and reverse can be made "on the go".

When you travel over muddy or slippery terrain, "power-transfer" differentials automatically transfer more power to the wheels with the best footing. This is another STANDARD on all four-wheel-drive "PAYLOADER" tractor-shovels.

Therefore, if you GET more at the start, if you SPILL less during travel, if you can travel faster with NO STOPS for shifting and better traction . . . you are going to be able to ***deliver*** MORE . . . and, after all, that's what counts.

Only "PAYLOADER" tractor-shovels have all of these PRODUCTIVE features which spell more PROFITABLE operations for the user.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

11-B-1c

you GET more

with GREATER choice

. . . of any and all kinds of financing.

What best fits your needs?

Do you want to purchase on a ***time payment*** plan? Your "PAYLOADER" distributor can offer you such a plan tailored to various periods to suit your needs.

Do you want a ***leasing plan**** with an ***option to purchase?*** He has a number of these which can be adapted to fit your requirements and preferences.

Do you want a straight ***leasing plan**** without a purchase option? He can provide "PAYLOADER" equipment for your operations on a straight leasing plan.*

Your distributor of "PAYLOADER" machines now has at his disposal the broadest and most complete set of financing plans and arrangements being offered.

He will be glad to discuss your needs for the finest equipment and offer you the greatest choice of terms. He will consider trade-ins.

He'll even take cash!

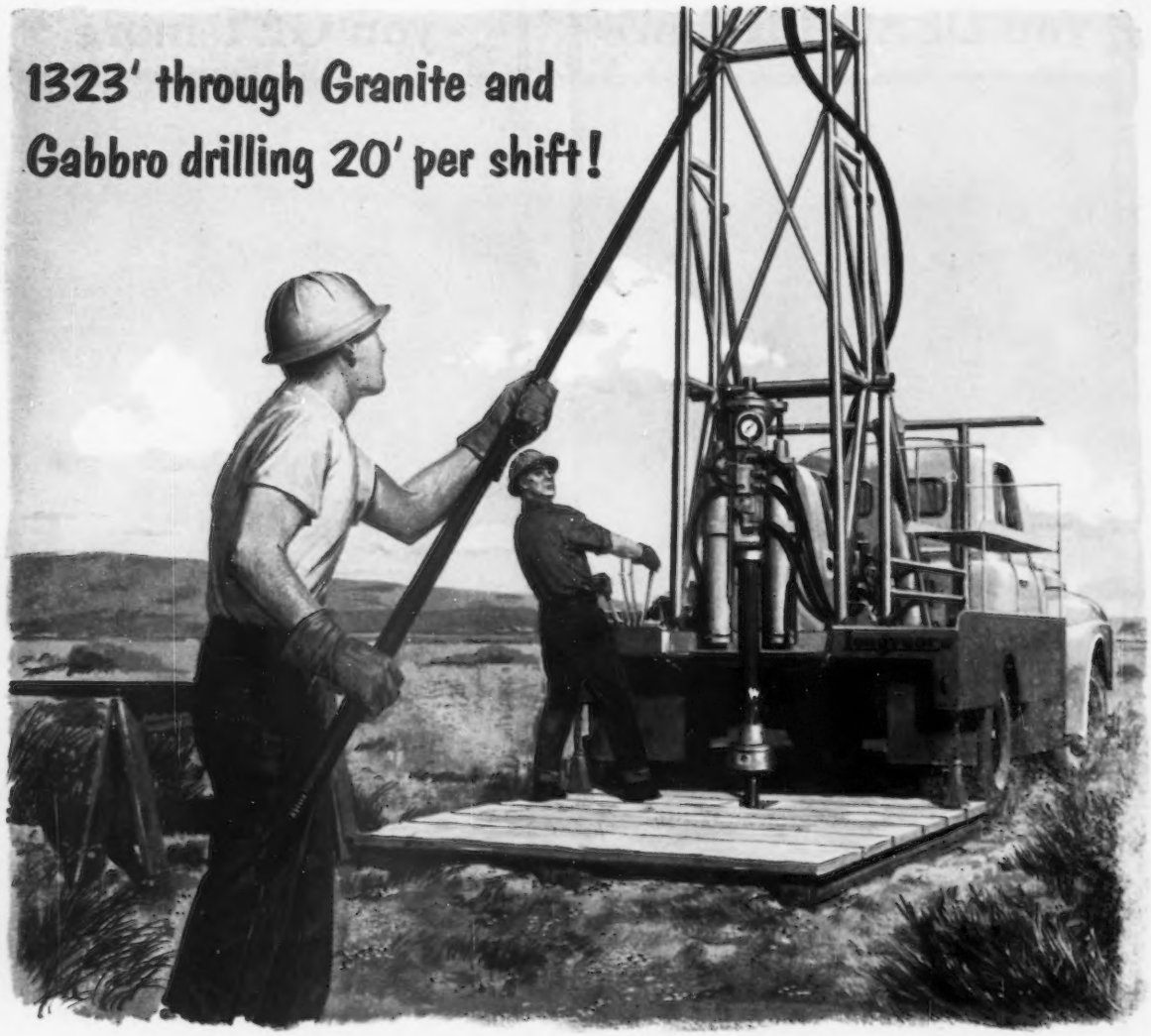
Consult him at once.

*(available in the continental U.S.A.)

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

11-B-1d

Report from the field . . .



Typical of Good Results With Longyear "W" Series Rods

Longyear "W" Series Rods head off trouble drillers encounter using ordinary rods. Here are four reasons why drilling costs are lower with "W" Series Rods.

1 Drill cuttings are discharged at the surface faster because the smaller space between the rod and the hole wall increases the velocity of the discharge water.

2 "W" Rods are stiffer. Increased diameter makes the drill string less flexible, more stable. Closer fit in the hole minimizes vibration, reducing gear and bearing wear in the drill.

3 Coupling openings are 22% to 88% larger than in E, A, B, and N couplings. Thus, with proper pumping facilities, an adequate water supply is more easily pumped across the face of the bit, minimizing the chances of burning due to lack of water.

4 Improved thread design makes coupling and uncoupling easier and faster.

Longyear "W" series rods are matched in advantages and performance by other components of Longyear *Coordinated Systems* for diamond drilling, including the finest drills, pumping units, diamond bits, and core barrels.

For complete information on Longyear "W" Series Rods, write for Longyear World No. 3, E. J. Longyear Company, Minneapolis 2, Minnesota

E. J. LONGYEAR COMPANY
76 South 8th Street • Minneapolis 2, Minnesota
CANADIAN LONGYEAR, LTD., NORTH BAY, ONT.
LONGYEAR, N.V., THE HAGUE, HOLLAND
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Diamond Core Drill Manufacturers • Core Drilling Contractors
Mining Engineering and Geological Consultants

Longyear

THE WORLD IS OUR WORKSHOP

The only REVERSIBLE cap and adapter made...

Try this on- for SAVINGS!

Service-proved WEARPACT Cap Type Tooth —with foolproof retainer—cuts digging costs to record lows . . . even in taconite!

robably by now you've heard of Wearpact Steel—the alloy ith a combination of hardness and toughness not available any other commonly used alloy.

Here's a new tooth and adapter design* cast in longer- earing Wearpact . . . the ASF Cap Type Tooth and adapter -the *only* such tooth and adapter that's reversible for longer fe. Note that the tooth itself is self-sharpening. Keeps on *icing* through the ore and overburden—and when finally orn, there's less metal to throw away. *The tooth locks securely the adapter.* No ASF retainer has ever failed in service.

As for service life, the cost-per-ton figures in large mines eak for themselves. Lowest of any tooth on record! Give is dollar-saving tooth a try! Write today to arrange for n installation.

Cut your costs with WEARPACT

CAST ALLOY STEEL

A PRODUCT OF

AMERICAN STEEL FOUNDRIES

3700 Canal St., Indiana Harbor, Indiana

*Patent Pending.

Power shovel breaks down . . .

So quarry moves boulders with

All over the country, more and more dirtmovers are finding Michigan Tractor Shovels can effectively handle jobs once considered much too tough for rubber-tired equipment.

You've probably read about—or seen—Michigans digging pit-run gravel. Or breaking out reinforced concrete. Or clearing brush. Now here's another dramatic application.

Maintains pit production

The company involved, a large northeastern firm, had always had trouble maintaining pit production when any of their big power shovels broke down. One time this happened, they had a Michigan Tractor Shovel in the pit on demonstration. They decided to put it through the rugged test of rock loading.

Now own six Michigans

That was in 1954. Today, this company owns *six Michigan Tractor Shovels!* In emergencies these units effectively handle both rock loading and cleanup. They also handle *all* truck-loading of screened aggregates and other products of the multi-million-ton crushed stone plant. Management estimates their output "definitely greater" than output of loaders formerly used. Maintenance costs, over periods ranging up to three years, have been "satisfactorily low".

Boulders weigh up to 7 tons each

Note the photos. Above, one of the company's five 2¾ yard Michigan Model 175A's is moving huge boulders to stockpile for later sale as rip-rap. Each chunk weighs ½ to 7 tons . . . yet at no time has operator reported trouble handling them. Upper right, another Model 175A loads shot rock at the quarry face. Michigans' unobstructed dumping height, power shift, and power steer helps speed both emergency assignments.

Load 10 tons in 2 to 3 minutes

Stockpile loading (lower right) keeps the company's

This is the type of shot rock that must be loaded into trucks for transport to crushers. Michigan Tractor Shovels must be able to take a lot of punishment—and they do!

A full bucket every time saves trips, cuts handling costs of loading crushed stone or sand. This load weighed out at 7,000 lbs. This model Michigan can lift 15,000 lbs.

2¾ yard Michigan

2 yard Model 125A and most of the 2¾ yard Model 175A's busy most of the time. Good mobility and unexcelled breakout, *equally great* through the entire lifting arc, make quick work of this job. The Model 125A needs only 3 minutes to heap a typical 10 yard truck . . . the bigger Model 175A's require only 2 to 2½ minutes.

24 mph travel speeds odd jobs

Michigan speed pays off on odd jobs, too. Like cleanup of haul roads, stockpiles, and around crushers. Pushing loaded trucks up grade. Setting utility poles. Hoisting crusher screens and other heavy equipment. Switching railroad cars (up to 25 empties at once). Plowing and removing snow. Despite year-around work averaging 50 hours a week, company officials report "downtime negligible." And continuing, "The all-Clark-built, all-matched power train sure boosts efficiency. From power shift, power steer and 3-to-1 torque converter to planetary wheel drive axles . . . our '54 model has the same components as our newest rig . . . which certainly proves how good the Clark design is. We like the speed of loading . . . the speed between job sites . . . the excellent performance on emergency rock-handling . . . the lack of downtime . . . the ease of maintenance. That's why we've been repeat-buyers five times!"

Make your own test

A demonstration, gladly arranged by your local Michigan Distributor, will show you why you too should be a Michigan Tractor Shovel buyer. Put the demonstrator on your toughest loading jobs . . . we'll bet *our cost* of the demonstration *against your time* you'll really be *enthusiastic* about the results.

Michigan is a registered trade-mark of

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road
Benton Harbor 42, Michigan
In Canada: Canadian Clark, Ltd., St. Thomas, Ontario

Ready for shipment are these Wilfley Model "K" sand pumps manufactured in South Africa.

CENTRIFUGAL WILFLEY PUMPS

This Trademark Guarantees Money-Saving Performance

Day after day, in industrial plants throughout the world, the always-dependable quality of Wilfley Sand Pumps pays off in lower pumping costs. Wilfley Sand Pumps give you all these dollar-saving features:

Maintained high efficiency
Longer pump life
Quick, easy replacement of worn parts
Rugged construction
Versatility of interchangeable materials in wear parts: hard alloy irons or soft abrasion-resistant rubber.
Simple, efficient design for trouble-free operation.

Individual Engineering on Every Application

Wilfley Sand Pumps
"Companions in Economical Operation"
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Write, wire or phone for complete details.

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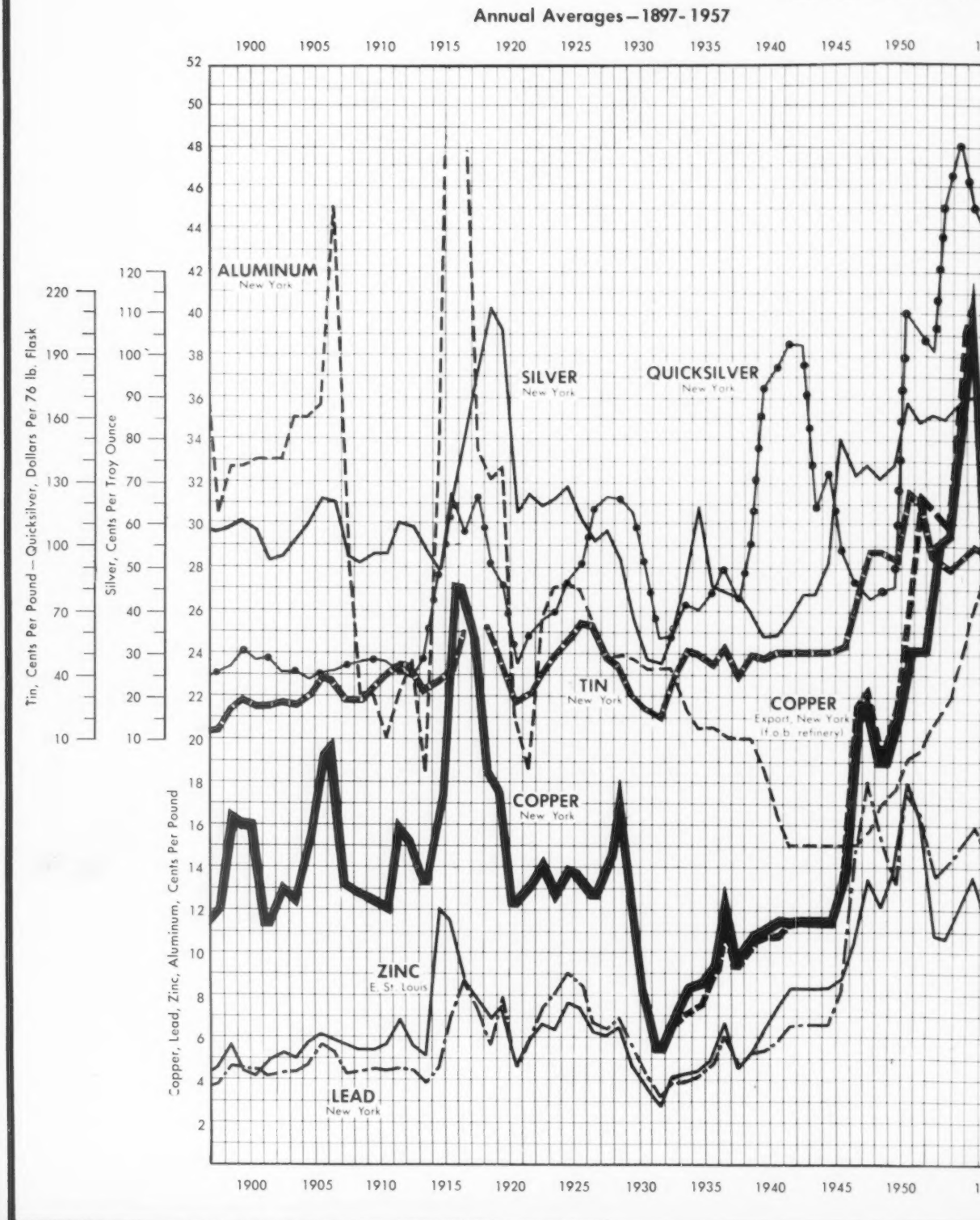


etal Prices

ournal and E&MJ Metal and Mineral Markets

ng Company, Inc., New York

E & M J Annual Average Metal Prices—1897 to 1957

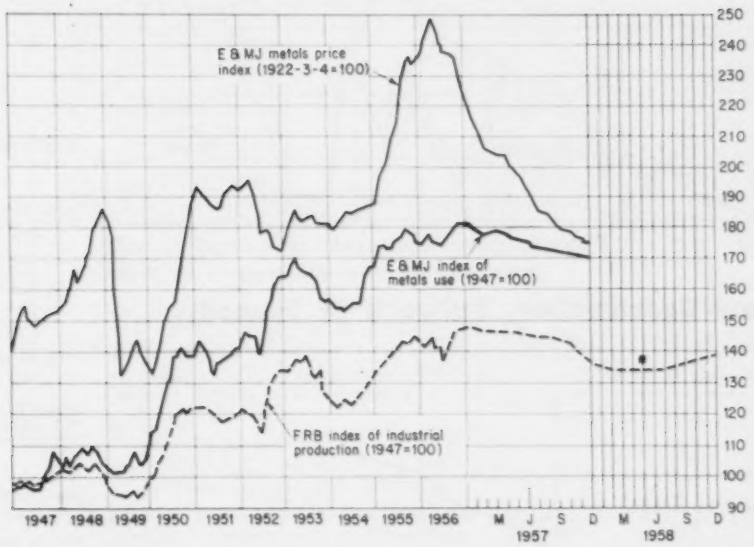
Year	COPPER (a) Domestic Refinery	COPPER Foreign Refinery	LEAD Common N. Y.	ZINC Prime Western (b) E. St. Louis	TIN (c) N. Y.	SILVER (e) N. Y.	QUICKSILVER (f) N. Y.	ALUMINUM Ingot
1897	11.29	.....	3.580	4.120	13.67	59.790	38.50	39.00
1898	12.03	.....	3.780	4.570	15.70	58.260	40.70	30.58
1899	16.67	.....	4.470	5.750	25.12	59.580	43.63	32.72
1900	16.19	.....	4.370	4.390	29.90	61.330	51.00	32.72
1901	16.11	.....	4.330	4.070	16.74	58.950	47.00	33.00
1902	11.026	.....	4.069	4.840	26.79	52.160	48.03	33.00
1903	13.235	.....	4.237	5.191	28.09	53.570	41.32	33.00
1904	12.823	.....	4.309	4.931	27.99	57.221	41.00	35.00
1905	15.590	.....	4.707	5.730	31.358	60.352	38.50	35.00
1906	19.278	.....	5.657	6.048	39.819	66.791	40.90	35.75
1907	20.004	.....	5.325	5.812	38.166	65.237	41.50	45.00
1908	13.208	.....	4.200	4.578	29.465	52.864	44.84	28.70
1909	12.982	.....	4.273	5.352	29.725	51.502	46.30	22.00
1910	12.738	.....	4.446	5.370	34.123	53.486	47.06	22.25
1911	12.376	.....	4.420	5.608	42.281	53.304	46.54	20.07
1912	16.341	.....	4.471	6.799	46.096	60.835	42.46	22.01
1913	15.269	.....	4.370	5.504	44.252	59.791	39.54	23.64
1914	13.602	.....	3.862	5.061	34.301(d)	54.811	48.31	18.63
1915	17.275	.....	4.673	13.054	38.590	49.684	87.01	33.98
1916	27.202	.....	6.858	12.634	43.480	65.661	125.49	60.71
1917	27.180	.....	8.787	8.813	61.802	81.417	106.30	51.59
1918	24.628	.....	7.413	7.890	88.750	96.772	123.47	33.53
1919	18.691	.....	5.759	6.988	63.328	111.122	92.15	32.14
1920	17.456	.....	7.957	7.671	48.273	100.900	81.12	32.72
1921	12.502	.....	4.545	4.655	29.916	62.654	45.46	21.11
1922	13.382	.....	5.734	5.716	32.554	67.528	58.95	18.68
1923	14.421	.....	7.267	6.607	42.664	64.873	66.50	25.41
1924	13.024	.....	8.097	6.344	50.176	66.781	69.76	27.03
1925	14.042	.....	9.020	7.622	57.893	69.065	83.13	27.19
1926	13.795	.....	8.417	7.337	65.285	62.107	91.90	26.99
1927	12.920	.....	6.755	6.242	64.353	56.370	118.16	25.40
1928	14.570	.....	6.305	6.027	50.427	58.176	123.51	24.300
1929	18.107	.....	6.833	6.512	45.155	52.993	122.15	24.300
1930	12.982	.....	5.517	4.556	31.694	38.154	115.01	23.787
1931	8.116	.....	4.243	3.640	24.467	28.700	87.35	23.300
1932	5.555	.....	3.180	2.876	22.017	27.892	57.93	23.300
1933	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934	8.428	7.271	3.866	4.158	52.191	47.973	73.87	23.300
1935	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938	10.000	9.695	4.739	4.610	42.301	43.225	75.47	20.000
1939	10.965	10.727	5.053	5.110	50.323	39.082	103.94	20.000
1940	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943	11.775	11.700	6.500	8.250	52.000	44.750	195.21	15.000
1944	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955	37.491	39.115	15.138	12.299	94.735	89.099	290.348	23.668
1956	41.818	40.434	16.013	13.494	101.409	90.826	259.923	26.010
1957	29.576	27.157	14.658	11.399	96.261	90.820	246.978	27.516

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99% in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for 11 months. (e) New York market. . . . All quotations in cents per lb, except for silver, which is in cents per troy oz, and (f) quicksilver, which is in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1957. See opposite page and reverse for weekly averages.

E & M J Weekly Average Metal Prices—1957

	COPPER		LEAD	ZINC	TIN	SILVER	QUICK-SILVER	ALUM-INUM
	Domestic Refinery	Foreign Refinery	N. Y. Common	E. St. Louis Prime Western	N. Y. "Straits"	N. Y.	N. Y.	99% plus, Ingot
Jan. 2	35.600	33.390	16.000	13.500	100.325	91.375	255.000	27.100
9	35.565	33.513	16.000	13.500	99.792	91.375	255.000	27.100
16	35.525	33.663	16.000	13.500	101.167	91.375	255.000	27.100
23	35.490	33.400	16.000	13.500	101.813	91.375	255.000	27.100
30	35.505	32.888	16.000	13.500	102.479	91.375	255.000	27.100
Feb. 6	33.980	31.521	16.000	13.500	102.458	91.375	255.000	27.100
13	33.469	30.942	16.000	13.500	101.750	91.375	255.000	27.100
20	32.270	30.579	16.000	13.500	99.896	91.375	255.000	27.100
27	31.363	29.638	16.000	13.500	98.600	91.375	255.000	27.100
Mar. 6	31.510	29.933	16.000	13.500	98.521	91.375	255.000	27.100
13	31.570	29.863	16.000	13.500	99.146	91.375	255.000	27.100
20	31.460	29.454	16.000	13.500	99.771	91.375	255.000	27.100
27	31.380	29.083	16.000	13.500	100.646	91.375	255.000	27.100
Apr. 3	31.330	29.621	16.000	13.500	99.354	91.375	255.000	27.100
10	31.570	29.971	16.000	13.500	98.792	91.375	255.000	27.100
17	31.525	29.654	16.000	13.500	99.604	91.375	255.000	27.100
24	31.515	29.896	16.000	13.500	99.854	91.375	255.000	27.100
May 1	31.510	29.604	16.000	13.500	99.604	91.375	255.000	27.100
8	31.490	29.779	16.000	12.750	98.875	91.375	255.000	27.100
15	31.030	29.575	15.500	11.750	98.250	91.375	255.000	27.100
22	31.360	29.258	15.000	11.500	98.104	91.375	255.000	27.100
29	31.215	29.250	15.000	11.500	98.313	91.175	255.000	27.100
June 5	31.363	29.067	15.000	11.300	98.525	90.875	255.000	27.100
12	31.370	29.033	14.667	11.000	98.375	90.725	255.000	27.100
19	30.755	28.729	14.000	11.000	98.333	90.225	255.000	27.100
26	28.840	27.375	14.000	10.500	97.625	90.250	255.000	27.100
July 3	28.820	27.021	14.000	10.271	97.438	90.250	255.000	27.100
10	28.788	27.254	14.000	10.000	97.325	90.250	255.000	27.100
17	28.785	26.767	14.000	10.000	96.292	90.250	255.000	27.100
24	28.580	26.546	14.000	10.000	96.104	90.250	255.000	27.100
31	28.550	26.479	14.000	10.000	95.979	90.375	252.000	27.100
Aug. 7	28.505	26.185	14.000	10.000	95.208	90.975	252.000	28.038
14	28.080	25.900	14.000	10.000	94.313	91.125	252.000	28.100
21	27.980	25.917	14.000	10.000	94.354	90.925	251.000	28.100
28	27.915	25.350	14.000	10.000	93.583	90.725	250.000	28.100
Sept. 4	27.225	24.763	14.000	10.000	92.975	90.625	250.000	28.100
11	26.455	23.683	14.000	10.000	92.875	90.625	246.000	28.100
18	26.200	23.738	14.000	10.000	93.667	90.532	245.000	28.100
25	26.520	24.017	14.000	10.000	93.583	90.625	244.000	28.100
Oct. 2	26.510	23.858	14.000	10.000	93.458	90.625	239.667	28.100
9	26.380	23.833	14.000	10.000	92.542	90.625	232.000	28.100
16	26.370	22.725	13.700	10.000	92.075	90.625	232.000	28.100
23	26.370	22.517	13.500	10.000	91.563	90.625	231.000	28.100
30	26.230	22.321	13.500	10.000	91.167	90.625	230.000	28.100
Nov. 6	26.138	23.283	13.500	10.000	90.150	90.625	230.000	28.100
13	26.500	23.692	13.500	10.000	89.675	90.500	230.000	28.100
20	26.460	23.192	13.500	10.000	89.667	90.375	225.000	28.100
27	26.160	22.592	13.500	10.000	87.729	90.175	225.000	28.100
Dec. 4	26.175	22.533	13.200	10.000	91.025	90.000	225.000	28.100
11	26.335	22.729	13.000	10.000	92.770	89.950	225.000	28.100
18	26.140	22.208	13.000	10.000	92.750	89.800	225.000	28.100
24	26.550	22.270	13.000	10.000	92.475	89.625	225.000	28.100
31	26.494	22.250	13.000	10.000	92.425	89.625	225.000	28.100

Postwar Relationship Between Industrial Production, Metals Use, and Prices of Major Nonferrous Metals—1947 to 1958



METALS USE INDEX shows close correlation to industrial production, but prices behave more erratically. Year 1958 is ruled vertically by months to enable you to plot monthly trends as they develop. *Indicates *Business Week* estimate of trend.

Industry Takes a Look at 1958

TWO THINGS CAN BE SAID FOR SURE about the 1958 outlook for the mining industry: (1) For the first time since Korea, virtually all metals will be in comfortable supply, (2) emphasis of the industry for the first six or eight months, at least, will be on selling rather than producing. An increasing number of sales and promotional pamphlets released recently by such organizations as the Copper & Brass Research Association, American Zinc Institute, Lead Industries Association, American Lithium Institute and individual companies in the light-metal and nonferrous metals industries show that new product and market development for metals is gaining momentum.

Forecasting the demand for metals and minerals for the remainder of the year is more hazardous. One guide is the fairly consistent relationship between the general prosperity of the economy and the mining industry as shown in the above chart. If we integrate the rash of year-end predictions made recently by economists, publications, economic groups, Government officials, financial writers, columnists and radio news commentators, we might easily conclude that 1958 will show a slow or slightly declining trend in the Federal Reserve Board Index of Industrial Production for the first six or seven months, followed by a year-end recovery as indicated in the projected curve above.

"As Capital Expenditures Go, So Goes Prosperity."

(In billions of dollars)

Year	Capital expenditures	Gross national product
1946	14.8	209.2
1947	20.6	232.2
1948	22.1	257.3
1949	19.3	257.3
1950	20.6	285.1
1951	25.6	328.2
1952	26.5	345.2
1953	28.3	363.2
1954	26.8	360.7
1955	28.7	390.9
1956	36.6	412.4
1957	38.6*	435.0
1958	**36.1****	***441.0**

*Estimated. **Planned.

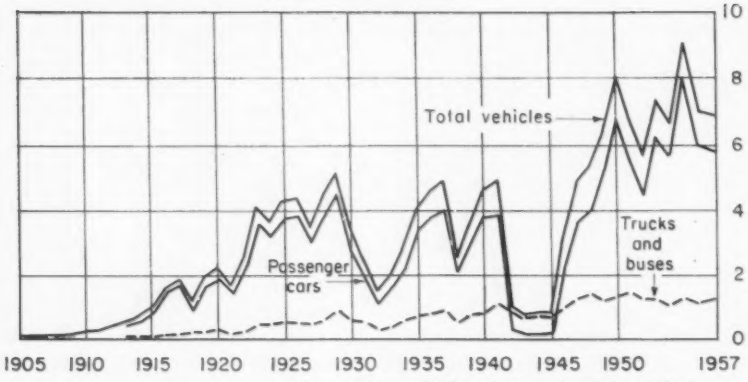
Industry's plans for capital investment are regarded as highly indicative of the economy's future by McGraw-Hill's Department of Economics. A recent article[1] by two of its staff members, entitled "As Capital Expenditures Go, So Goes Prosperity," explained that the "peculiar importance" of capital investment and the plans for it is based on these points: (1) a continuation of our high standard of living is dependent upon a high level of business investment, and (2) capital investment is the key element to both growth and stability of our economy.

Accepting this, we can attach special significance to the accom-

[1]Dexter N. Keezer and Margaret K. Matulis, *Industrial Marketing*, April 1957.

Annual Motor Vehicle Sales in U.S.

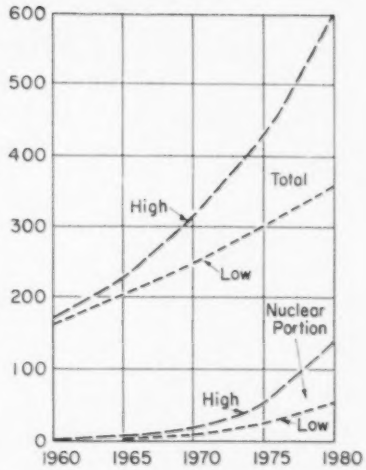
(Millions of vehicles)



Source: Automobile Manufacturers Association, 1957 Report.

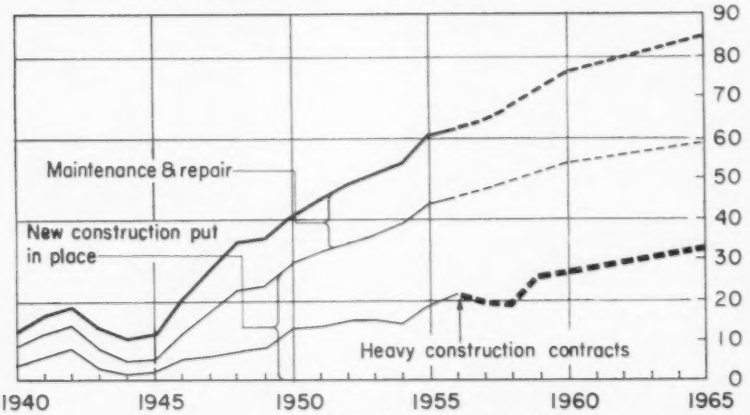
U.S. Generating Capacity

(Millions of kw)



Source: Peaceful Uses of Atomic Energy. Projected with high and low estimates. U.S. electrical generating capacity includes total and nuclear portion.

New Construction, Bulwark of Economy



Source: *Construction Daily* and *Engineering News Record*.

panying table on planned and actual capital expenditures which is based in part upon a survey of plans for capital investment made by the Department of Economics. The 1958 planned expenditures are estimated to be about 7% lower than those estimated for 1957.

A direct approach to the outlook for the mineral industry lies in the study of those industries which are heavy consumers of metal and mineral products such as the automobile industry, construction, the chemical industry, and the electric power and manufacturing industry. Curves for these industries indicate their momentum, and show that they are subject to cyclical swings of moderate amplitude. The current decline for these industries and business in general appears to be nothing more than a third cyclical post-war dip and not a serious recession.

Since the automobile industry consumes about 18% of the total U.S. use of steel, 7% of the copper, 42% of the lead, 18% of the zinc, 14 of the nickel and substantial quantities of aluminum, this industry merits particular study. 1957 wound up being the fourth best year in history, missing third place by only 20,000 units. U.S. totals as counted by Ward's automotive report were 6,115,467 passenger cars, and 1,079,000 trucks and buses.

Traditional year-end statements by auto makers were cautiously optimistic for 1958 at best. General Motor's president Harlow Curtice said, "As we try to look ahead, an all important factor in the business picture is confidence—confidence on the part of business and the consumer. For various reasons confidence at present appears to be somewhat shaken, and an attitude of caution appears to prevail. This can have a substantial effect on the level of the economy."

Curtice said that at year-end his company's sales were running at the rate of 5½-million passenger cars for the calendar year. Ward's automotive report projects production for 1958 at 5.3-million units. Trucks are expected to hold firm at 1.1-million units.

World production of cars in 1956 (latest year figures are available) totalled 11.7-million including trucks and buses. U.S. production accounted for 64% of the total. Other important car-manufacturing nations included Canada, 474,276 units; France, 827,048; West Germany, 1,075,619; Italy, 315,793; Japan, 216,570; USSR, 491,000; and United Kingdom 1,006,203. Exports of cars, trucks and busses for 1956 were as follows: West Germany, 484,598; U.K., 463,164; and U.S., 372,442. Recent reports indicate that European car manufacturers are continuing to outsell U.S. producers in the foreign market. The foregoing figures are indicative of the highly industrialized nations of the world which are competing for metals and raw materials in world markets, and which were responsible in part for the soaring metal prices in 1955-56.

Current and planned expenditures in the construction industry must also be weighed in an outlook for metal consumption. The accompanying chart for heavy construction, new construction, and maintenance and repairs shows a strong steady growth pattern—also three moderate post-war dips, one of which is cur-

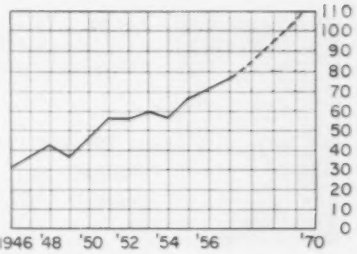
Electrical Industry Outlook

Sales (Billions of kwh)	1958	1957	1956	1955	1954
Residential	**161.5**	146.8	133.9	120.5	108.5
Industrial	**295.8**	285.4	275.7	249.2	200.2
Commercial	**102.9**	95.4	87.7	80.2	73.4
Other	**35.0**	33.5	31.9	30.4	28.9
Totals	**595.2**	561.1	529.2	480.9	410.9
Capital expenditures (Millions of dollars)					
Generation	**2,460**	2,226	1,479	1,547	1,939
Transmission	**821**	779	598	571	666
Distribution	**1,754**	1,618	1,518	1,343	1,288
Miscellaneous	**225**	208	186	161	122
Totals	**$5,260**	$4,831	$3,781	$3,622	$4,015
Capacity additions (Thousands of kw)					
Conventional	**13,529**	13,876	13,666	7,126	5,557
Nuclear	**635**	190	0	73	0
Hydro	**1,100**	1,122	2,746	1,301	918
Totals	**15,264**	15,188	16,412	8,500	6,275

Source: *Electrical World*

Chemical Process Industries Value of Output

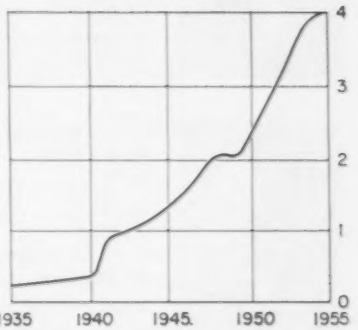
(Billions of dollars)



Sources: U.S. Department of Commerce. *Chemical Week* estimates.

Growth of Research In the United States

(Billions of dollars)



Source: Based on estimates from the Research and Development Board and the Steelman Report.

rent. On the whole the construction industry looks for 1958 to be "about the same as for 1957." The backlog of proposed heavy construction projects in the planning stage as reported by *Engineering News Record*, Dec. 31, 1957, totals $109,676,000, or enough to sustain the 1957 contract rate for 5.7 years. Housing starts, which have been declining, are turning up again, partly because of an infusion of lower interest loans. Highway construction contracts totaling $3.5-billion are forecast for 1958. The 1957 total was estimated at $3.2-billion.

Expansion and planned capital outlays for the power and electrical construction industries will continue at a high level as shown in the accompanying table. The long-range outlook for power requirements is also shown. Such new "power hogs" as air conditioning installations, which have increased five-fold since 1950, are pressuring power companies to increase kilowatt capacities. Expansion in power generating capacity at a rate of about 15.3-thousand kw per year means that production of power consuming, generating, and transmitting equipment, all of which are important to the copper, aluminum and steel industries, must increase commensurately.

Kilowatt-hour energy sales will increase to more than 600-billion in 1958, topping the 1957 total by almost 8%, according to estimates reported by G. A. Price, president of Westinghouse Electric Corp. He estimated that backlogs of the electrical manufacturing industry at the close of 1957 totalled about $10-billion.

Chemical processing, which consumes some $850-million worth of metals and mineral products each year, should continue to provide a good outlet for products of the mining industry. The accompanying chart shows a healthy growth pattern.

Aircraft production rose 10% in early 1957 and then dropped sharply by year-end so that 1957 production was close to that of 1956. Output is expected to continue to decline during the first half of 1958. For 1958 as a whole, aircraft and parts output will be about 10% below 1957.

Research is the new ingredient that is adding considerable stability to the economy. While its impact on demand for materials is hard to assess, there is no question that research and new product development have made the aluminum, molybdenum and nickel industries what they are today. More and more economists are coming out flatly with the opinion that the U.S. economy needs only about 50 to 60% of the products it buys today—the the balance is consumed only because research coupled with intensified selling creates new products and a public demand for these products. If the economy is indeed skating on such thin ice, it's encouraging to note that soaring research budgets are giving us the momentum we need to keep from falling through. See accompanying chart of research expenditures in the U.S.

Actual or planned research budgets of American industry show an impressive rate of growth, according to a recent McGraw-Hill survey. Expenditures made by American industry for research and development were about $4.8-billion in 1955, $6.1-billion in 1956, $7.3-billion in 1957 (estimated), and $9.3-billion in 1960 (planned.) By 1960 the manufacturing industry expects sales to be up 26% —with half the increase in products that were not made in 1956.

Government activities have an important influence upon the course of the economy. In normal years important decisions on such matters as defense plans, foreign trade policy, agriculture, labor-management relations and taxes, and, more specifically, for the mining industry, tariffs, stockpile buying and barter arrangements all have a distinct impact upon the business outlook. Since 1958 will be a congressional election year, both parties will unquestionably shape their campaigns and their votes on the legislative floor to garner favorable voter reaction. The controversies already brewing indicate a bi-partisan intent to keep the economy strong.

In brief, 1958 will be one of the most competitive years in post-war history, and could be a year of quick economic changes•

Major Metals

Dr. M. A. Kriz
Chief, Foreign Research Div.,
Federal Reserve Bank of N. Y.

"World gold output rose 1.6-million oz . . . stocks of U.S. [end of 1957] were $799-million above 1956."

Francis H. Wemple
Treasurer
Handy & Harman

"There are new, growing uses of silver in missile field and other weapons. . . . Demand is below 1956."

George H. Cleaver
Market Editor
E&MJ

"The copper industry begins 1958 with poor prospects. Belated output reductions may firm the market."

R. L. Ziegfeld
Secretary
Lead Industries Association

". . . Figures indicate domestic lead mine output down some 4- to 5,000 tpm from first half of 1957."

Charles R. Ince
Vice President
St. Joseph Lead Co.

"Mushrooming air conditioning market is calling for large tonnages of galvanized zinc sheet."

Irving Lipkowitz
Assistant to the President
Reynolds Metals Co.

"Aluminum industry has seen no reason to alter materially its long range expansion program."

J. Donald Hanawalt
Vice President and Manager
Magnesium Dept., Dow Chemical Co.

"For 1958, tripled consumption of magnesium-thorium alloys is expected. Tooling plate sales will rise."

J. R. O'Connell Jr.
Assistant Market Editor
E&MJ

"Tin Council will hold the spotlight in 1958, an unenviable position — under tremendous pressure."

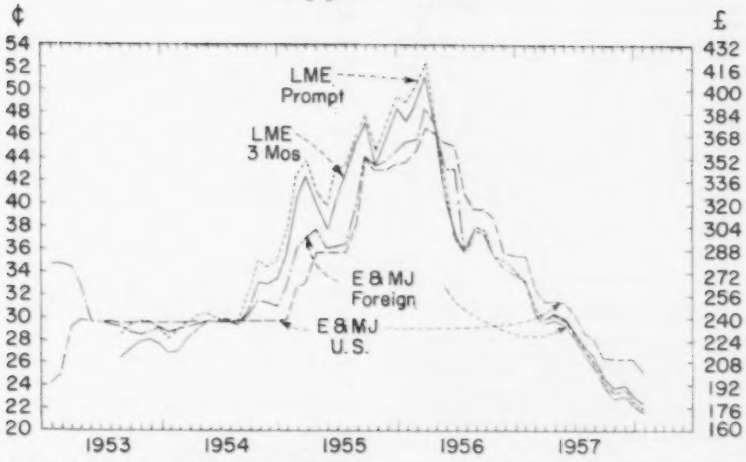
James W. Franklin
Associate Editor
E&MJ

"By the end of 1958, Free World uranium output will be 40,000 annual tons — or more than the market."

Daniel P. Eigo
Managing Editor
E&MJ

"Titanium's future depends on civilian aircraft, castings, and its corrosion resistance. Prices will be cut."

Copper Prices



Monthly averages. London Metal Exchange prices, average of the mean of the bid and asked, refer to long tons; the two scales are equal at an exchange rate of $2.80 per £—£320 per long ton is 40c a lb. etc. Data through Jan. 1958.

Copper Statistics[a]

(Thousands of short tons)

U. S.	1957	1956	1955
Output			
Mine	1,115	1,133	1,036
Secondary (b)	437	468	514
Refined	1,614	1,580	1,467
Imports (c)			
Ore, etc	129	122	126
Blister	302	276	254
Refined	154	192	202
Exports, refined (c)	370	223	200
Stocks, producer	181	121	62
Del. to fabricators	1,275	1,466	1,446
Del. by fabricators (d)	1,285	1,416	1,314
Apparent consumption (e)	1,069	1,367	1,335
Actual consumption (f)	1,352	1,521	1,502
Fabricator stocks (end of yr.) (d)	425	437	390
World			
Mine output	2,899	2,863	2,614
Refined output	3,033	2,987	2,728
Refined, del to fabricators	2,850	2,833	2,744
Stocks, producer	458	354	221
Prices, per lb, in cents			
E&MJ U.S., f.o.b.	29.576	41.818	37.491
E&MJ foreign f.o.b.	27.157	40.434	39.115

(a) Unless otherwise indicated, based on Copper Institute data. An estimated 430,000 tons of Free World copper (all outside the U. S.) are not reported to C. I. Also, an estimated 450,000 tons produced in the USSR or allied areas are excluded.

(b) From old scrap. Bureau of Mines data.

(c) American Bureau of Metal Statistics.

(d) Estimates based on Copper Association data and exclude much product produced from secondary copper. Copper content of products.

(e) Based on data from U. S. Bureau of Mines. New refined copper withdrawn from total year's supply on domestic account.

(f) Based on Bureau of Mines data, which reflect actual reports by fabricators, foundries and chemical users.

Copper

George H. Cleaver
Market Editor

THE COPPER INDUSTRIES entered 1958 with poor prospects. Prices charged by U.S. producers had tumbled from a high of 46c to 25c. Custom smelter prices had fallen from 54½c to 24c; dealers in the U.S. were underselling smelters by nearly 1c. Electrolytic copper could be bought in Europe for about 21c.

Almost all persons in the copper industries knew where the trouble lay—output had increased and failed to fall as demand dropped. Prices of refined copper is largely a function of two forces: current and anticipated demand for copper containing fabricated products, and current and anticipated supply of refined copper. During the period of rapidly rising prices late in 1955 and early 1956, U.S. fabricator stocks of copper and copper products rose by about 100,000 tons (see U. S. copper fabricating chart). This suggested that even then consumption and sales of fabricated products may have been less than the supply of refined copper. But demand for refined copper and unfilled orders for fabricated products remained high. In *E&MJ*, May 1956, p 69, we said: ". . . declines in output, voluntary or otherwise, or a resurgence in demand, will be needed. If not . . . price drops can continue until they get into the neighborhood of costs for the high cost producers—then production cutbacks may take over."

The first announced voluntary reductions in output occurred in the fall of 1956. Since then, Free World total reductions at an annual rate have been about 324,900 short tons. Part of this has been high cost copper that in effect has been forced out; part has been copper, the cost of which was above the price. The latter, most would say, was indicative of some measure of rationality. But the cuts have been too slow, and possibly even yet too few.

A world struggle for markets became more evident in 1957. This struggle, which many would say is inevitable in a free enterprise economy, was partly responsible for the delay in output reductions. Until stocks reached levels at which producers felt they had a good backlog to engage in this struggle, there was little inclination for voluntary reductions. It was easier in the U.S. than out. As stocks grew, their holders could reduce output with less fear of being caught short.

The sharper competition is partly indicated by the increase in exports of copper from the U.S. (see table above). Much of this copper originated in Chile, but some of it was mined in the U.S. The impact was clearer in Europe than in the U.S. Some realignment of purchasing occurred in Europe especially, and Chilean producers doubtless increased their sales there. (Kennecott announced it would build an 84,000 ton capacity refinery in Maryland. A 42,000-ton refinery to handle copper from the small Chilean mines may be built at Papudo, in Chile.) Some other sellers may have lost sales. The aggressive selling by agents of the Chilean producers some attribute to the policy of the Chilean Copper Department, which most believe is in effect an arm of the Chilean government. At least one of the Chilean producers probably felt it would have been wise to reduce Chilean output early in 1957. But if production was to continue at high rates, a market had to be found for it. And if expansion plans were to be followed through, even years ahead, markets needed to be prepared.

But these markets are not stable.

U.S. Copper and Brass Mill Shipments

(millions of lb)

	Sheet	Wire	Rod	Pipe, tube	Total
Copper					
1955	273	6	72	468	819
1956	223	9	88	418	737
1957	190	6	67	381	644
Brass and Other Alloys					
1955	614	105	589	162	1,470
1956	526	88	489	158	1,261
1957	471	78	391	142	1,082

American Bureau of Metal Statistics.

U.S. Brass and Bronze Ingot Shipments*

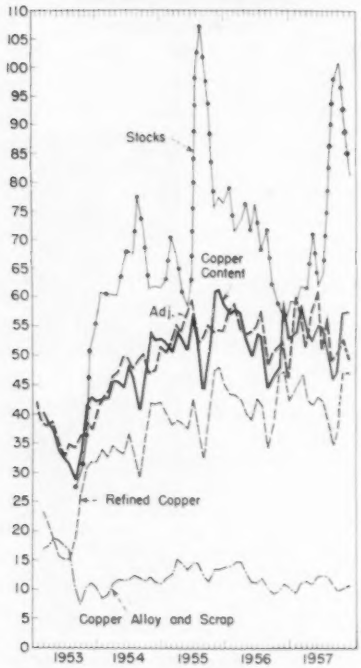
(short tons)

1955	314,100	1952	292,400
1956	288,500	1953	285,500
1957	261,400	1954	277,100

American Bureau of Metal Statistics data based on statistics from Defense Council, Brass and Bronze Industry.

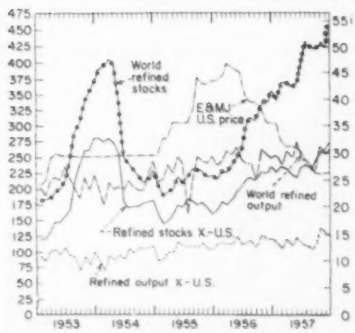
*About 80% is copper.

U.K. Copper Fabricating



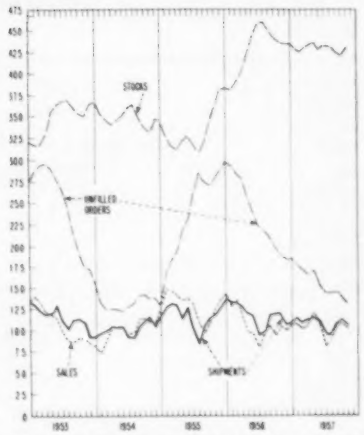
Data in thousands of long tons from British Bureau of Non-ferrous Metal Statistics. All series except stocks refer to copper content of fabricated products. All are two months moving averages except stocks and the one marked "adj." The last is the copper content series adjusted for seasonal variation—this adjustment mainly eliminates the regular low of April, July and August, and the high in March and September through December. Data through November 1957.

Copper Output and Stocks



Statistics in thousands of short tons from the Copper Institute. World refined output and stocks exclude the USSR, Japan, the Scandinavian countries, Australia, Yugoslavia and the Messina Mine in the Transvaal. The two series "X—U.S." are the above world series exclusive of the U.S. Stocks exclude those held by fabricators. Data through December 1957.

U.S. Copper Fabricator Data



Data in thousands of short tons from U. S. Copper Association. The sales and shipment series are related only to purchases of refined copper by the fabricators, including copper refined by custom smelters from their intake of scrap and concentrates. All series are for fabricated products except stocks which are of refined copper and copper in process. November is the last month indicated. Sales and shipment series are two months moving averages.

Copper Output Reduction*

(Short tons, annual rate)

Company	Mine	Tons	Eff. Date
United States			
Anaconda:	Montana	24,000	Nov. '56
	Yerington	5,000	July '57
Phelps Dodge	Ajo, Bisby,	23,000	Nov. '56
	Morenci and	4,800	Apr. '57
	Lavender Pit	14,200	Oct. '57
		21,000	Feb. '58
Miami Copper:	Copper Cities	8,400	July '57
	Miami	1,600	July '57
Howe Sound:	Chelan	6,000	July '57
Appalachian Sulphides (a):	Elizabeth, Vt.	4,000	Jan. '58
Banner Mining Co.:	Arizona	2,200	Oct. '57
Inspiration Cons.:	Arizona	6,000	July '57
Coronado Copper:	Arizona	1,600	Aug. '57
Calumet & Hecla:	Osceola, etc.	1,800	Sept. '57
Cyprus, etc.:	Pima	3,000	Jan. '58
Kennecott:	Utah, Nevada & N. M.	45,600	Jan. '58
	Ray	6,000	Apr. '57
Total U. S.		178,200	
Africa			
Rhodesian Select. Trust:	Roan Antelope, Mufulira	20,000	July '57
Anglo American: (d)	Kansanshi (b)	4,000	Aug. '57
Newmont, etc.:	O'Okiep	4,800	Apr. '57
Tsumeb Corp.:	Tsumeb	4,800	Oct. '57
Katanga:	Various	25,000	May-July '57
Total Africa		58,600	
Chile			
Several:	Several	30,000	Nov. '57
Anaconda:	Chuquicamata	30,900	Feb. '58
	Potrerillos		Feb. '58
Total Chile		60,900	
Canada			
Granby Cons.:	Granby	10,000	Apr. '57
Howe Sound:	Brittania	3,600	Dec. '57
Other (c):	Other	9,600	Late '57
Total Canada		23,200	
Other			
Peru:	Cerro de Pasco	4,000	Jan. '58
Total Free World		324,900	

*New projects may offset these to some extent. Strike losses are excluded.

(a) This is being offset, at least in part, by the firm's new Ore Knob mine.

(b) Not voluntary reduction; mine flooded.

(c) Beattie-Duquesne, Lyndhurst, Coldstream (?), Woodgreen Copper, Mid-West Copper, etc.

(d) Anglo-American said it will stop production at its Bancroft mine in Rhodesia in March 1958. This will mean 27,000 tons less than anticipated. This probably does not constitute a reduction relative to 1956 or 1957.

And long term contracts, even five-year contracts, do not always guarantee the seller his outlet. This is especially so when the buyer has an option to reject the metal on a 60-day notice. And if his contract price is fixed by the London Metal Exchange price he can resell his copper the same day on which his buying price is fixed. This means he can in effect resell the copper at the same price he paid for it. He then stands almost no chance of loss. If his contract is fixed by the LME prompt price, and the futures price is higher—it has been higher most of 1957— he can sell futures and make the difference between this price and the prompt price. Even though a buyer may agree not to resell, recent experience indicates such an agreement is hardly binding. The willingness of the seller to buy the copper back from the purchaser (certainly a wise policy since it maintains his control over the metal and reduces the extent to which this freely floating copper depresses the market) may mean, in effect, the seller actually has no sales contract. The buyer may prefer to resell all or part of the copper on the London Metal Exchange; he may then force down the price he pays for what copper he does consume. In some cases he may not benefit by this—the price he gets for his fabricated product may drop by an equal amount. The amount of this resale copper to some extent influences the premium which often must be paid over the LME contract price in order to purchase specified copper shapes (the LME is ordinarily a market for contracts, for paper, rather than for metal). At times a buyer may receive copper at the actual LME contract price from a large producer and resell it at a premium. This practice tends to depress the premium.

Custom smelters in the U.S. were concerned about falling copper prices, but they may be less distressed than producers. Certainly their discomfort has been much less than the higher cost producer's. The producer can do little to reduce costs. The custom smelter reduces costs rather easily. Most of his cost is for purchased ore and concentrate; if the amount he pays for this material drops by the amount his selling price falls, his net income drops only to the extent his volume falls. By keeping his price under the producer price, the custom smelter in the U.S. has maintained more of his volume. This lesser discomfort from lowered prices, many producers believe, contributes much of the force for dropping prices.

It is only a slight exaggeration to say that what the custom smelter is to the producer in the U.S., the dealer is to the custom smelter. The smelter's actual cost, after he has acquired the ore, is about 5c a lb. The dealer is a merchant. His costs are largely the cost of money, of office staffs and

space and communications. His capital turns over much more rapidly than the smelter and especially the producer. His margin is very small on any transaction. But the same costs for producing copper is involved in the copper he sells. But his business in the U.S. is different from his business outside the U.S. In the U.S. he gets business largely because he undersells all other sellers. He can do this because prices here are much higher than elsewhere at times when the market is not strong. His organization permits him to buy in low price markets and sell in high price—U.S. —markets. When he has concentrates refined here he takes a smaller margin when he sells the refined copper. A third reason is that much more often than not he is a successful speculator —in a weakening market he will sell at today's price and buy later. He is also able to get and resell distress lots.

Outside the U.S. the dealer market is much different. In a weak market he often sells for near term delivery at prices above the producer's. Some of the low price producers in Europe are not in the spot market. They do not stock copper in Europe and therefore cannot supply on short notice. The seller who does can often get a premium. Also, many producers will not sell at fixed prices ahead or will only do so at rather high prices. The dealer, largely owing to his proficiency in hedging, but in some cases to his ability as a speculator, will sell ahead at fixed prices that are lower than the producer's. He may give longer credit.

Attempts to agree on prices or pricing policy, or on production restrictions, were reported from Europe. In May 1957, the two Rhodesian copper producers probably reached an agreement to the effect that they would both use some sort of flat price policy. The plan was reported rejected by consumers. The RST group had been selling at flat prices since May 1955; it changed this price occasionally as the market situation made necessary. Early in October 1957, RST abandoned the flat price policy.

In December 1957, representatives of Rhodesian producers, Katanga and the Chilean Copper Department met in London. Many factors expected some agreement on production restrictions and possibly on pricing policy to come from this meeting. In January, the Chile Copper Department recommended a 10% cut. Anaconda cut 10% in Chile.

Tariff pressures in the U.S. have mounted as prices have fallen. For a number of years a 2c per lb import duty on copper and copper contained in products has been suspended. In the case of products the import duty was reduced by that amount. The suspension ends June 30, 1958, unless Congress again provides otherwise. Mining state Congressmen doubtless will see it is suspended no more. If the price delivered drops to under 24c as indicated by *E&MJ* for a calendar month, the duty will automatically go into effect. International agreements entered into two years ago provide for a drop in most duties so that on July 1, 1958 a 1.7c duty will go into effect rather than the 2c duty. It will be 1.8c if the duty becomes effective before July 1. Present duties on imported fabricated products vary greatly — some are about 5c; these would increase by 1.7c too. Presumably the duty would not hurt fabricators.

Many Western Congressmen have sponsored a bill to provide a 4c import duty to go into effect when the U.S. price is 30c. The duty would apply to the copper content of fabricated copper and brass products, as well as refined and blister copper and copper in ore. Many analysts believe this or a bill essentially the same will become law. Doubtless U.S. mining interests will be helped though U.S. firms with foreign copper holdings may be damaged. The discrepancy between the price of copper products outside the U.S. and inside will increase considerably.

Imports in 1957 into the U.S. of copper containing fabricated products rose probably about 10%; imports in 1956 were higher than 1955. The increases mainly reflect the higher cost in the U.S. of refined copper—in many cases the U. S. fabricator has paid 4 or 5 c per lb more, about 20% —and higher labor costs. Owing to higher costs in the U.S. fabricators raised their margin on extras early in November 1957.

The difficulties of the U.S. copper industries are not wholly a result of increased imports. The market for fabricated products in the U.S., which showed signs of weakening early in 1956, has declined considerably. Automobile output and residential housing both were down in 1956 and have shown no significant improvement. Most consumer durable goods output is down. Data for December 1957 are not available for the various copper consuming industries, but the increase in unemployment and the decrease in industrial production suggest they are down. The Federal Reserve seasonally adjusted production index for December 1957 is 11 points, about 5%, under December 1956. Frank R. Milliken, vice president of Kennecott, in September 1957 attributed the poor market largely to low

(*Continued on p. 188*)

Copper Mine Capacity*

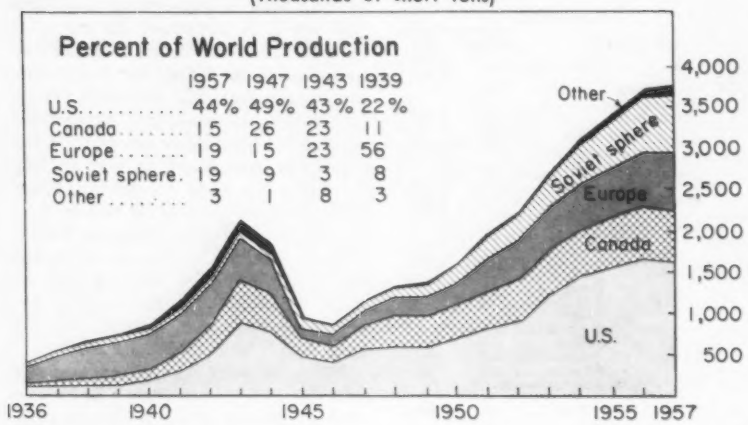
(Thousands of short tons, annual rate)

	Company or mine		Capacity change	Capacity
	United States			
1956				1,150
1957				1,186
1958	San Manuel		10	
	Ore Knob		3	
	Elizabeth		−4	1,195
1959	Ray		20	
	Berkeley Pit		13	1,228
1960	Esperanza (Duval Sulphur)		22	
	Christmas Mine		10	1,260
1961	Christmas Mine		3	1,263
1962				1,263
	Outside U. S.			
1956				2,183
1957				2,259
1958	Canada:	Gaspe	5	
		Geco	11	
		Tilt Cove	10	
		Waite Amulet	−3	
		Willroy	2	
	Rhodesia:	Bancroft**	24	
		Nchanga	26	
	Fr. W. Africa:	Mauritania	5	
	Total Outside U. S.		80	2,339
1959	Canada:	Geco	4	
		O Pemiska	5	
		Campbell Chibougamau	5	
		Waite Amulet	−2	
		Copper Rand	10	
		Cowichan	5	
		Others	8	
	Rhodesia:	Bancroft	24	
	Uganda:	Kilembe	5	
	Fr. W. Africa	Mauritania	6	
	Transvaal	Messina	5	
	Bel. Congo	Katanga	20	
	Chile:	Mantos Blancos	6	
		La Africana	3	
		Braden	18	
		Potrerillos	−18	
		El Salvador	10	
	Philippines:	Atlas	6	
		Sipalay	5	
		Lepanto	2	
	Australia:	Mt. Isa	10	
	Sweden		−5	
	Nicaragua:	Rosita	5	
	Israel:	King Solomon	7	
	Turkey:	Murgul	3	
	Total Outside U. S.		147	2,486
1960	Canada:	Opemiska	4	
		Campbell Chibougaman	5	
		Waite Amulet	−2	
		Copper Rand	10	
		East Sullivan	5	
		Others	3	
	Rhodesia:	Molly Norah	9	
		Bancroft	24	
	Uganda:	Kilembe	3	
	Fr. W. Africa	Mauritania	11	
	Transvaal:	Messina	5	
	Bel. Congo	Katanga	20	
	Chile:	El Salvador	65	
		Potrerillos	−25	
	Peru:	Southern Peru Copper	60	
	Australia:	Mt. Isa	10	
	Philippines:	Sipalay	5	
	Total Outside U. S.		212	2,698
1961	Canada:	Waite Amulet	−2	
		East Sullivan	5	
		Others	3	
	Rhodesia:	Mufulira West	58	
	Bel. Congo:	Katanga	20	
	Peru:	Southern Peru Copper	84	
	Australia:	Mt. Isa	10	
	Yugoslavia:	Majdenpek	14	
	Chile:	El Salvador	25	
	Total Outside U. S.		217	2,915
1962	Yugoslavia:	Majdenpek	14	
	Total Outside U. S.		14	2,929

*Some projects announced in past years have been postponed and possibly abandoned.
**Bancroft development to continue.

World Aluminum Production

(Thousands of short tons)



Aluminum

Irving Lipkowitz
Reynolds Metals Co.

PRODUCTION and shipments by the aluminum industry tapered off slightly in 1957, from the record levels reached in 1956. Primary production was down about 2% and shipments to consuming industries were about 6% lower.

The industry's 1957 performance is better viewed, however, from the perspective of the last few years. A plateau was reached in 1955, after a rather steep five-year climb which began with the Korean War in 1950. Primary production had jumped 118% during that period and shipments had climbed about 71%. The 1957 performance, while less favorable than in 1956, was nevertheless 129% above the 1950 level in primary production and shipments were still 66% higher. The general economy, during the same period (1950-57), showed only a 25% increase and the Federal Reserve index of industrial production rose 28%. Consequently, the plateaus achieved in production and shipments by 1955 were generally being maintained in 1957.

Basic long-term prospects remained unchanged. They still point to market growth on a large scale. No major markets were lost to competing materials during 1957 and the number of uses and consuming industries continued to increase. Consequently, there has been no cancellation of primary capacity programs, only stretch-outs because of the slowdown in business. On the contrary, some European countries announced new expansion plans late in the past year.

The general slowdown in business brought an intensification of inter-industry competition, since all major industrial materials are now in plentiful supply and the capacity to produce them exceeds current demand. Within the aluminum industry, the greater availability of supply has stimulated more aggressive market development and sales campaigns as well as more vigorous competition for existing markets.

Production—Primary aluminum production in the U.S. amounted to about 1,649,000 tons during 1957, slightly below the all-time peak of 1,679,000 tons reached in 1956. It was the first time in six years that a new production record had not been set. Capacity, however, had increased to over 1.8-million tons during 1957, compared with 1,839,000 tons at the end of 1956.

Power shortages, strikes and market conditions all contributed to the drop in production. Shortages of interruptible power compelled the industry to shut down a substantial part of its Pacific Northwest capacity during February and March. Some production was also lost in the Tennessee Valley area about the same time because of power shortages. During June and July, one producer shut down 15,000 tons of annual capacity because of general business conditions. In August, Northwest aluminum production was again curtailed because of power shortages, resulting in a shutdown of about 60,000 tons of annual capacity. Another plant, the largest in the area, shut down 44,000 tons of annual capacity, a fourth of the plant's total, late in December. In all, about 6% of the nation's aluminum capacity was idle at the end of 1957.

Canadian production was considerably lower in 1957 than in 1956 (560,000 tons as against 620,000 tons), despite an increase in capacity. The principal reason was an 18-week strike at Canada's largest plant which resulted in a loss of 130,000 tons in primary production. When this plant went back into operation, in the fall, only 75% of the capacity was activated. Canada's second largest plant, in British Columbia, experienced an interruption in production during December when a rock slide cut off the plant's power supply.

Canada's second and newest producer, Canadian British Aluminium Co., began production Dec. 23, upon the completion of the first stage, 45,000 tons, of its primary plant. The second stage, another 45,000 tons, is scheduled for completion in late 1958.

Primary aluminum production in the rest of the world increased during 1957, particularly in Western Europe and in the Soviet bloc of countries. Western Europe stepped up its production from 675,000 tons in 1956 to 714,000 tons. The principal gains were made by France, West Germany, Austria and Italy.

The most significant development in the world aluminum picture is the continued sharp expansion of Soviet production. Russia itself is reported to have increased primary aluminum production 21%, to a new record peak of 603,000 tons. Russia was thus the world's second largest producing country. On a regional basis, the Soviet group, with a 1957 output of 708,000 tons, was close behind the world's second largest producing area—Western Europe. Although production in some satellite countries (Hungary, East Germany, Czechoslovakia and Poland) declined 29,000 tons in 1957, Russia's own 103,000 ton increase more than offset it. The Soviet bloc accounted for about 80% of the net world increase in primary production. World production advanced from 3,705,000 tons in 1956 to 3,752,000 tons in 1957.

Aluminum ores total bauxite supplies increased about 11% during 1957, even though the requirements for current aluminum production had declined slightly. Bauxite was required,

however, not only to supply other consuming industries (chemicals, abrasives, refractories) but also to provide initial stocks for new alumina facilities and to meet Government stockpile purchase requirements. Domestic mine production fell off 14% and imports went up 18%:

Bauxite

(Millions of tons)

	1956	1957
U. S mine production	1.7	**1.5**
Imports	5.7	**6.7**
Totals	7.4	**8.2**

Imports accounted for 82% of the 1957 bauxite supply, a larger share than ever before. Jamaica, Surinam, British Guiana and Haiti were the principal sources of these imports. Haiti became a regular source of bauxite during the second quarter of 1957.

Bauxite and other aluminum ore explorations were actively conducted in various parts of the world, from Australia to Siberia. The Australian deposit, announced in June, was reported to contain hundreds of millions of tons of bauxite. It was stated at the time that this newly discovered deposit might "prove to be the largest in the non-Communist world."

The Communist world also announced the discovery of very large aluminum ore deposits. In March, *Tass*, the Soviet news agency, reported that three large deposits were found in Eastern Siberia. The ore was described as nepheline syenite which is generally of lower grade than the bauxites being used commercially in the Free World. The report further stated that "when fully developed," these deposits could yield aluminum ore in quantities "equal to all the bauxite reserves outside the Soviet Union."

During the year, new bauxite development or exploration activities were also reported in Borneo, Costa Rica, Jamaica, Panama and Portuguese West Africa and Guinea. Other important bauxite developments were the 25-year income tax and royalty agreements which were made between Jamaica and the three aluminum producers now mining bauxite in that country.

Aluminum shipments to consuming industries (mill products, such as sheet, extrusions, wire, foil, etc., plus ingot for castings and destructive uses) amounted to 1,940,000 tons in 1957, or about 85% of that year's total supply. The 1957 shipments were about 6% below the all-time peak of 2,055,000 tons reached in 1956 and 3% below the 1955 level, but were still a substantial 66% higher than in 1950.

Aluminum Mill Product Shipments, By Product

(Thousands of tons)

	1957	1956	1955	1950	Increase 1950–59
Sheet and plate	**607**	690	672	513	94 (18%)
Ingot for castings and destructive uses	**583**	611	603	339	244 (72%)
Extrusions and tube	**398**	396	388	129	269 (208%)
Rod, bar, wire, cable and forgings	**237**	249	219	127	110 (87%)
Foil	**101**	95	99	51	50 (100%)
Powder and paste	**14**	14	18	11	3 (27%)
Total	**1,940**	2,055	1,999	1,170	770 (66%)

While total shipments declined in 1957, some of the individual product groups showed net increases over 1956, notably extrusions and foil. (See accompanying table.)

The variations from group to group reveal a changing pattern since 1950. Sheet and plate, although still the largest class of products, showed the smallest relative increase since 1950, only 18%. Extrusions and tube showed the largest percentage jump, 208%, and the largest tonnage gain—269,000 tons. Foil also made a sharp advance, doubling its tonnage shipments since 1950, while the rod, bar, wire group was up 87%.

A significant feature of this growth pattern is its relationship to the development of small enterprise in the industry. The extrusion and tube group, which has had the largest increase in shipments, also leads all other groups in the number of relatively small companies. It has been estimated that there are over 125 companies in this field, aside from the primary producers. The vast majority of them have come into the industry since 1950.

U.S. total supply of aluminum declined, compared to 1956, because primary imports dropped off, as well as domestic production, and scrap supply showed only a slight rise:

U. S. Aluminum Supply

(Thousands of tons)

	1956	1957
Primary		
Domestic	1,679	**1,649**
Import	231	**225**
Scrap (Recoverable content)	440	**450**
Total	2,350	**2,324**

Domestic primary production and scrap supplies were ample by themselves to meet 1957 consumption requirements. With primary imports continuing on a substantial level, the total 1957 supply proved more than sufficient to meet current demand. Over 350,000 tons of 1956-57 primary production were put to the Government by the producers under the terms of Korean War contracts which provided for the private construction of 663,000 tons of mobilization capacity. Aluminum inventories in the hands of consuming industries during this same period seem to have declined more than their actual consumption has and are believed to be at a relatively low level.

Basic aluminum price changes in 1957 continued to reflect cost changes, just as they did in prior years. In the interest of market development, speculative pressures to advance the base price more than cost increases warranted had been resisted during the many years of short supply since World War II. Similarly, in August 1957, the one cent per pound increase in price, from 25 to 26 cents, reflected only some of the advance in costs — such as materials, services, transportation and power, as well as wages and fringe benefits.

The effectiveness of the market development basis underlying aluminum prices in times of plenty as well as in times of shortage, is demonstrated by the inability of competing metals to recapture, during 1957, markets which had previously been lost to aluminum. The precipitous drop in 1957 copper prices, for example, had not caused any major users who had replaced copper with aluminum to switch back. Neither had the decline in zinc prices brought any reversal in the trend towards aluminum in automotive applications, at the expense of zinc-based alloys as well as other materials.

Confused conditions developed during 1957 with respect to extrusion and cable prices. These prices deteriorated without any compensating benefits such as the penetration of new markets or the significant expansion of old ones. Profit margins suffered, diminishing the funds available for product and market development in these fields.

Imports. Under current market conditions, the statistics on imports are not an adequate measure of their impact on the domestic industry. This is particularly true in the case of fabricated products. Foil imports, for example, are not a significantly large segment of total foil shipments in this country. However, such imports are heavily concentrated in certain specialty fields—such as florist or condenser foil—and are a serious factor in those branches of the foil industry. Similarly, sheet and rod imports affect certain specialty markets much more than general statistics would indicate.

The geographic distribution of imports is also a factor. They normally appear principally in Atlantic seaboard markets, especially since a large share of them originate in Western Europe. The extent to which they affect business in these market areas is not apparent from statistical comparisons on a national basis.

Outlook. The aluminum industry expects to sell more aluminum in 1958 than it did the year before. Inter-industry competition will undoubtedly be vigorous with competing materials in plentiful supply. Primary and fabricated aluminum products will also be in plentiful supply, from both domestic and foreign sources, making for a highly competitive aluminum market.

These supply conditions, however, must be considered in the light of the market development prospects which face the industry. The possibilities for expanding existing markets and developing new ones are still very bright. The industry therefore has seen no reason to alter materially its long-range expansion program. Significantly, the adjustment to 1957 and probable 1958 business conditions is taking the form of a stretch-out, not a cancellation, of expansion programs.

The industry generally is strongly conscious of the fact that more than three-fourths of the time between the end of World War II and the early part of 1956 aluminum markets were characterized by shortages which seriously hampered market development. The need for an assured ample supply is recognized as essential to continuous expansion of markets and uses. The automotive industry's increased usage of aluminum for decorative as well as functional parts, for example, has been stimulated during the past two years by aluminum's greater availability.

Until 1957, capacity was a reliable measure of probable primary production. In 1958, market conditions will be the determining factor. The industry has already made adjustments in this direction, with about 110,000 tons of annual capacity temporarily idle in the Northwest. In Canada and West Germany, too, there are idle primary facilities awaiting the development of larger markets before they are reactivated. Although additional capacity (including two new domestic producers) is scheduled to come into production during 1958, total aluminum supply is expected to continue to reflect market requirements, with assured availability for new as well as established uses.

Sales and market development will be the focus of the industry's efforts in 1958, as it was in 1957. The indications are that, if anything, the drive in this direction will be more vigorous than ever before, both because of the momentum built up by sales and promotional campaigns already under way and because of the greater competition from other basic materials. Underlying these marketing activities is the industry's strong conviction that break-throughs to new mass markets can be achieved and, with proper effort, will be achieved•

Iron Ore and Steel

AS STEEL GOES, so goes the iron ore industry—this is a rule often quoted by experienced producers in the Iron Country. Accordingly, let's look to steel for its appraisal of the future. The answer appears in the year-end reviews and forecasts made by the heads of a number of large steel companies. These are the basis for the following review and outlook.

There seemed to be almost complete agreement among reviewers that the decline in steel output from 117-million tons in 1955, to about 113-million tons in 1957, was brought about by a moderate drop in general business activity in the U. S., plus a marked tendency of consumers to reduce inventories in the last half of 1957. The fact that consumers changed rather abruptly from inventory building in early 1957 to inventory cutting during the remainder of the year created a distorted demand situation which could only be met by operating steel mills at low capacity (about 78% of capacity for the last quarter).

Current low-level steel production rates are expected to continue through the "early months" or "the first half" of 1958, and after that period of inventory liquidation, "steel industry operations will accelerate somewhat at about mid-year," according to one reviewer.

Specific estimates of 1958 output were as follows: "According to the best information available, steel industry production in 1958 may settle out at 100-million to 110-million ingot tons. This is somewhat less than production in 1957 . . . but 100-million tons is still a lot of steel."—Avery C. Adams, president, Jones & Laughlin Steel Corp.

"Steel inventory movements will continue to be a dominant consideration in evaluation of the outlook for steel in 1958. Our estimates of national output and steel consuming industry activity during the first half of 1958 indicate that total steel use will show some decline from the record pace of 1957."—Roger M. Blough, chairman, U. S. Steel Corp.

"My estimate is that ingot production will total 50- to 52-million tons during the first six months of 1958. Looking beyond the first half, I would expect improvement, with production 5 to 10% higher in the second half."—Joseph L. Block, president, Inland Steel Co. Using the lowest limits, this would indicate a 1958 total of 105-million tons.

"In the next year [1958], production will swerve back onto an upward course, and may total 110-million net tons of ingots and steel for castings."—Max D. Howell, executive vice president, American Iron and Steel Institute.

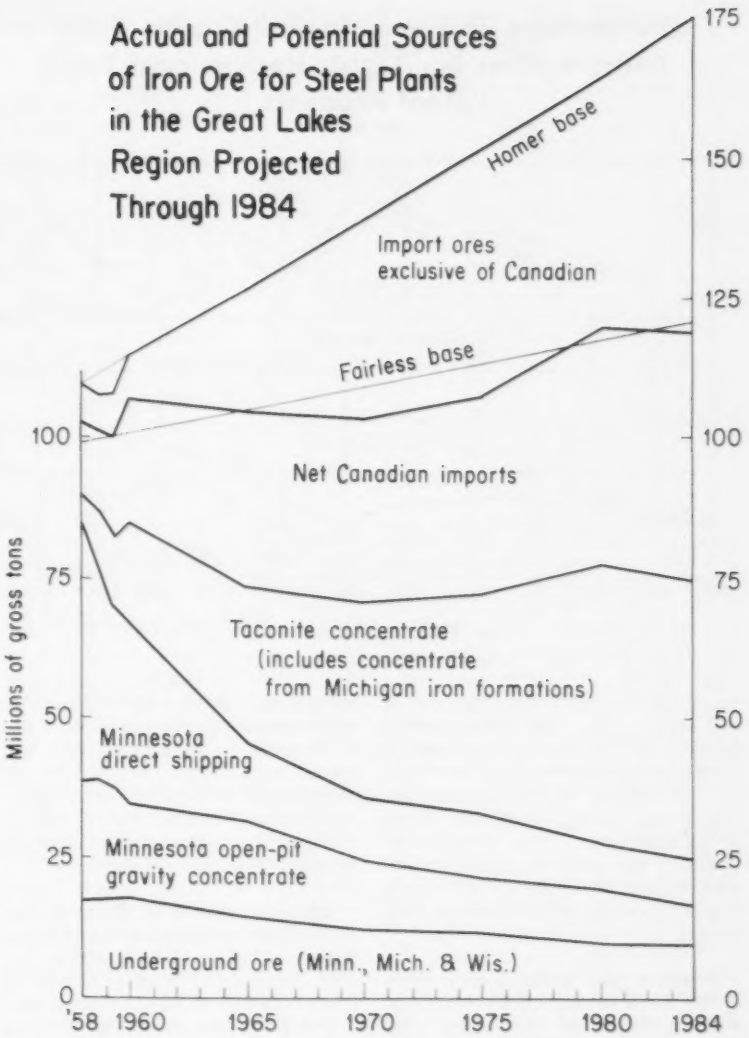
Several reviewers commented on the tendency of reports to express production in terms of per cent of capacity. This could lead to a distorted impression of actual activity in the steel industry because actual capacity has jumped from 91.5-million tons at the end of World War II to 133.5-million tons at the start of 1957. Steel-making capacity for Jan. 1, 1958 was estimated by Mr. Block to be more than 140-million tons.

Looking ahead, agreement was general that expansion plans will

have to go ahead despite the current lull in demand. U. S. Steel has authorized nearly $700-million to be spent on "additions to and replacement of facilities to keep the corporation prepared to meet anticipated steel requirements of its customers and ready to meet the demands of national emergency." Mr. Blough estimated that "To meet the challenge of our expanding economy, 30- to 40-million tons of ingot production capacity will have to be added in the next 10 to 12 years."

Looking still further into the future, R. F. Sentner, vice president of U. S. Steel, told purchasing agents in May 1957 that "Our analysis of the future leads us to believe that by 1975 fully 50-million additional tons will have to be added to present capacity, at a rate of increase consistent with the growth of the American economy."

What an increase in steel-making capacity of such proportions will mean to the iron ore industry is shown in the accompanying chart by Verne D. Johnston showing potential sources of iron ore for steel plants projected through 1984.



Projected iron ore requirements and sources based on estimates by Verne D. Johnston, consultant to Oglebay Norton & Co.

Population growth is still the basic factor used to make long-range estimates of steel requirements. Clifford H. Hood, president of U. S. Steel, told the Indiana State Chamber of Commerce members recently, "Perhaps few Americans realize it, but percentage-wise we have one of the highest rates of population increase in the world. It is higher than that of Japan or India, and it is probably higher than the rate of increase in Russia. The important fact, however, is that people make markets for the products we produce, and at the present time we are netting an average gain every 24 hours of 8,000 new customers for the products and services of American business and industry."

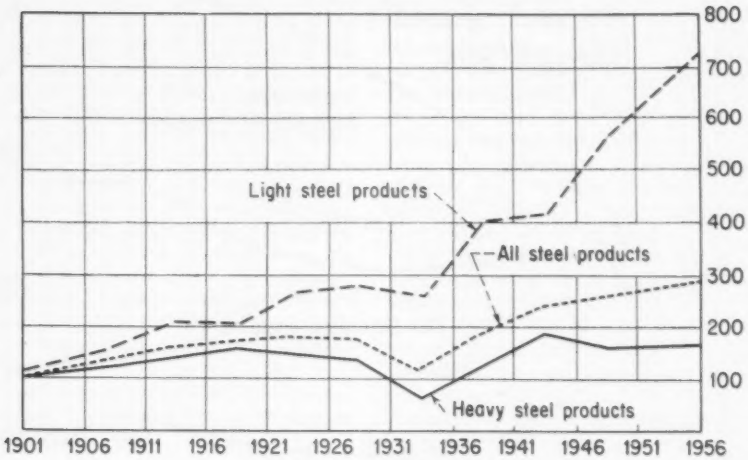
The rate of population increase for the U. S. is about 2.1% per year, and for the entire world about 1% per year. Compounding this with the increase in per capita consumption of steel as shown in the chart on page 120, it is obvious that steel planners have to look beyond year-to-year business swings when estimating future requirements for steel and iron ore.

Increasing labor costs were also noted by most reviewers. Mr. Howell reported that in the latter half of 1957 hourly employees' earning reached an average of $3 per hour." Steelworkers also receive benefits of about 20c per hour paid by the steel companies for pensions, insurance, social security and supplemental unemployment benefits. This indicates that hourly employment costs have risen over 8% from 1956 to 1957, he said. On the same subject, Mr. Hood said "In U. S. Steel, total employment costs per hour rose at an annual rate of more than 8%, compounded annually, from 1940 through 1956. This was three times the increase in our product output per man-hour compounded annually over the same period of time, and that output reflects the installation of new and improved machinery."

Problems of financing the substantial increases in steel-making capacity were discussed by some reviewers. Mr. Block came out flatly with the opinion, "Current steel prices are inadequate. They do not permit a proper return on the investments in new facilities which the industry must continually make for modernization and expansion." Speaking from a tax angle, Mr. Blough observed· "Replacement costs of facilities today are three to six times that of equipment costs in 1940, an indisputable fact which the tax laws do not recognize."

In the field of steel technology, two new advances were cited: (1) Harleston R. Wood, president of Alan Wood Steel Co., said that an iron powder plant is scheduled for completion in 1958 which will be the second direct reduction plant built

Percentage Increase in Per Capita Steel Consumption For Light, Heavy, and Total Steel Products
(1901=100)



SOURCE: Republic Steel Corp. Commercial Research Division.

using the fluidized bed method of reduction. By this revolutionary method, he said, iron powder will be produced for molding parts, for welding rod coatings, for flame cutting and high-grade melting stock; (2) Jones & Laughlin Steel Corp. recently announced the start of production of steel by the revolutionary new Basic Oxygen Process at its Aliquippa, Pa., works.

Principal steel producing countries of the world during 1957 were: U. S. with an output of 113-million tons; Soviet Union, 56-million tons; West Germany, 27-million tons; and U. K., 23.9-million tons. Steel imports in the U. S. on the basis of nine-month figures were 950,000 net tons, or an increase of 6%, as compared with the corresponding period of 1956. About 42% of the imports came from Belgium-Luxembourg. The U. S. exported about 4.13-million tons of steel products in the first nine months of 1957, or an increase of 30% over the comparable period of 1956.

Iron ore supplies of the nation in 1957 were reported by the U. S. Bureau of Mines to be largest in history. Preliminary estimates indicate that domestic mines produced over 105-million tons of usable iron ore and that imports totaled close to 34-million tons. All mining districts contributed to increased iron-ore production and the total from mines in the Western States was a record high. The value of domestic output was about 10% higher than in 1956.

M. S. Fotheringham, president of Steep Rock Mines, Ltd., of Canada, observed in a year-end report that "Steel makers who are zealously selective and who traditionally take a long-term view, prefer to know their raw material sources 25 years in advance. For the Canadian iron ore industry, this not only calls for continuing research and greater attention to product development and marketing methods, but it also means that production and assurance of increasing quality of product must be planned in detail now."

The urgency for establishing iron ore sources as much as 25 years ahead of requirements is certainly reflected in the feverish search that is now going on all over the world for new reserves, not only by U. S. companies but also by representatives of the nations who have rebuilt their steel-making capacity after World War II. In Brazil, representatives of four nations were bidding competitively for the concession and development of iron ore deposits.

New methods for the direct reduction of iron ores which now top the heap of interest in new technology could easily change the entire economic structure of iron mining and shift interest to areas which were previously ruled out as being uneconomic. Savings in freight by removing the silica and oxygen from the ore at the mine could be substantial and make concentrated products competitive with direct shipping ores. In fact, steel makers are now thinking in terms of not only up-grading low-grade ores, but high-grade ores as well, because of freight savings and the possibility of greater throughput in the blast furnace•

Tin

J. R. O'Connell Jr.
Assistant Market Editor

THE TIN MARKET IN 1957, like many of the nonferrous metals, was hit hard in the second half by the faltering U.S. economy. Most metal markets found rough going right from the beginning of the year. During this period tin managed to keep its head above water, thanks to the support of the International Tin Council's Pool.

As late as August, Sir Douglas Waring, chairman of Kuala Kampur Tin Fields Ltd., speaking at that company's annual meeting, was able to say: "There has been an even closer balancing of production and consumption than was previously anticipated and any further upsurge in industrial activity could well result in the position of equilibrium being reached. For this reason it is clear that any regulation of production will not take place this year and may in fact be postponed for some . . . time."

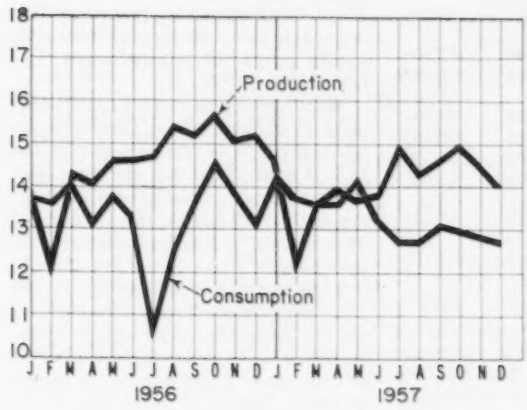
Early in December, at an emergency meeting, ITC cut export quotas by 28½%.

Many of the questions that faced 1957 tin market forecasters were answered early in the year:

The Government-owned tin smelter

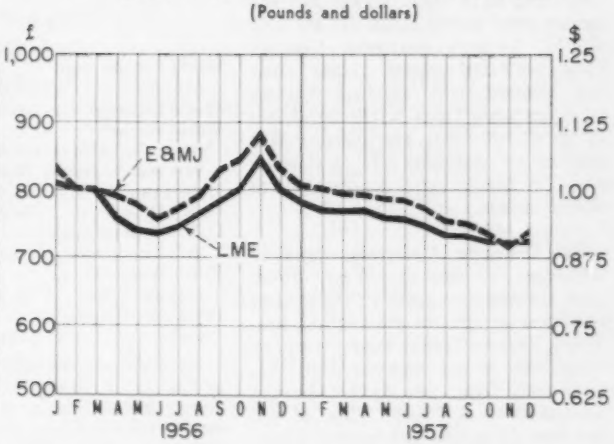
World Tin Production and Use

(Thousands of long tons)



E&MJ and London Tin Prices

(Pounds and dollars)



at Texas City was shut down Jan. 31. During that first month of 1957, 1,565 tons of metal were produced for the U.S. Government stockpile. Earlier in the month the smelter had been sold to Wah Chang Corp. No tin was produced there in the final 11 months of 1957. Bolivian and Indonesian ores previously smelted at Texas City are being sent to the U.K. for refining.

The future of tin stockpiling in the U.S., after sale of the Texas City smelter, was another question to be answered as the year began. Early in 1957 the ODM, in a report to Congress, announced that both short and long-term objectives had been completed for the stockpiling of tin. At that time GSA revealed that all Texas City production from 1953 on had been officially transferred to the national stockpile. This amount is known to be about 106,000 tons. Estimates of the total hoard range between 300,000 and 400,000 long tons.

Seizure of the Suez Canal and its subsequent blockage in 1956 caused shipping difficulties that carried over through the first quarter of 1957. Middle East tension continued in the first half, sporadically tightening prices, but eased later in the year as attention focused on Russian scientific advances and sliding U.S. business indicators.

Shippers adjusted to re-routing schedules quickly. Once a schedule was arranged, few hardships other than an occasional delayed arrival, occurred. Transportation returned to normal in the spring, when the Canal was cleared.

Serious strike activity, both in the U.S. and in Malaya, was limited to the first quarter, though occasional threats were heard in Malaya in later months. The Butterworth Smelter of the Straits Trading Co. at Penang, Malaya was struck early in January. Wage negotiations were closed in mid-March after a 62-day halt. The strike helped maintain firm world prices. Ore was diverted to Malaya's other two smelters with few disruptions in the market.

The New York dockworkers struck on Feb. 12, after having been restrained from so doing for 80 days by Presidential injunction. Prices firmed at the strike's inception, but eased when an early settlement was forecast. The strike ended about one week later.

What might be termed an unhampered market began in April. Missing, however, was the vital consumer. Business indicators and weakness in most metals turned the consumer into a market observer. The situation continued through the end of the year.

The past year marked the initial positive action on the part of the International Tin Agreement. Barely organized at the end of 1956, the group was called on to act fast and often in 1957. Were it not for ITC support, the prices of tin would be well below the levels at which they began 1958.

ITC met in March, June, July, October and December. Each session was newsworthy and action taken was generally a sharp barometer of market conditions.

At the March meeting the floor price was raised by £90 from £640 to £730. The ceiling of £880 remained unchanged. The new scale: Below £730 (91.25c), the manager must buy; between £730 and £780 (97.5c), the manager may buy; between £780 and £830(103.75c), no buying or selling; between £830 and £880 (110c), the manager may sell; and above £880, he must sell.

The Council explained that mining costs had risen since 1953 and there was danger that some marginal producers would go out of business. It was also stated that a rise in the floor price was necessary to aid labor in underdeveloped countries, and to assist countries whose economies were heavily dependent on tin.

Consumers, though not pleased with the increased support level, felt it would help insure the ceiling of £880. Under the old scale it had been impossible for the Agreement to acquire tin, needed if metal is to be sold in time of shortage.

The Council noted that Thailand had ratified the Agreement. Austria was also welcomed as a participating member later in the year. The U.S. has yet to join forces.

At the June session, the Council estimated the 1957 surplus of production over consumption at 5,000 to 7,000 tons; announced that Canada had notified the Council of intention to sell 3,000 tons of its stockpile tin, probably during 1958; and that the British Board of Trade had postponed disposal of 2,500 tons of metal until late in 1957.

The July meeting was relatively uneventful. At that time it was announced by the Council that the buffer stock held no tin metal as of Mar. 31. The Canadian government revealed that they did not visualize offerings of their stockpile metal at prices below £830 a long ton.

At the October session it was an-

nounced that the buffer stock totalled 3,916 tons as of June 30, but that the current total would reach 10,000 tons shortly. Council chairman Georges Pefer predicted export quotas when this amount was reached. Surplus estimates were from 6,000 to 7,000 up to 12,500 tons. The increase was credited to continued sale of Russian metal in Europe and decreased Free World output.

The December 4 meeting, originally scheduled for late in January 1958, gave a sharp indication of the critical condition of the tin market. As predicted, exports quotas were set up, to cover the period between Dec. 15, 1957 and Mar. 14, 1958. The cut amounted to a 28½% slice of the previous 12-month production schedule of the producing countries. At the same time it was arranged for the manager to sell at the neutral level, in order to prevent a sharp rise in prices during the cutback period.

Most observers feel the sale of Russian tin in Europe in 1957, conservatively estimated at 6,000 tons, has been the greatest contribution to the present poor state of the world tin market. Russian sales at discount prices took most sellers by surprise in 1957.

However, of greater concern to U.S. sellers as 1958 begins is the consumer. No amount of support in London can make up for the lack of consumer business here. Sellers are frankly worried. Barring international incidents, they look for no immediate pick-up in the first half of the year. Polled consumers see no increase in their needs. Some have postponed deliveries. Some tinplaters report their own personal stockpiles. A few consumers have switched to alloys, available at discounts. Aluminum inroads in the can field have caused no joy in an already weakened market.

Primary Tin Statistics

(Long tons)

	1957	1956
World mine output.....(c)	**170,000**	175,000
World consumption	**160,000**	160,500
World stocks:		
Gov'ts included (a)	**403,000**	393,000
Gov'ts excluded (b)	**80,000**	70,300
U. S. consumption..	**56,000**	60,700
U. S. import (pig)..	**60,000**	62,600
U. S. output (pig) at Texas smelter.	**1,565**	17,631
Price, av., N. Y. prompt.....	**96.261c**	101.409c
Price, av., London, cash.....	**£754.8**	£787.7

(a) This estimate was arrived at by adding to the International Tin Study Group figure for the end of 1947 of 135,000 tons, the excess output over consumption each year. (b) I.T.S.G. figure. (c) Excludes U.S.S.R.

No pick-up is forecast before the second half of the year. Some sellers feel consumers have cut inventories to the bone, operating on two-month inventories rather than the customary four. They feel necessity alone can force buying interest.

Despite the acute lack of business, prices are expected to hold or soften only slightly in the first half. Observers predict ITC export quotas will be extended into the second quarter, and some go as far as to forecast further cuts in output, should the current demand situation persist. Many feel ITC is unlikely to cut its support level after having purchased approximately 15,000 tons at £730.

World prices in 1957 were at their peak in January when London averaged £789.2 for the month and the U.S. 1.013c. Low for the year was November with London £730.3 and the U.S. at 89.4c. On the strength of ITC quotas, prices had risen as the year closed.

With consumption lagging in the U.S., the world's largest consumer of tin, the tin market must remain weak. Just how weak depends on a number of factors. Will the Russians continue to sell in Europe in 1958, and, if so, how much? How much will British and Canadian release of stockpile metal hurt market balance? Observers are discounting the possible hold-up in shipments of Indonesian metal as a firming factor, now that Dutch firms have been nationalized. Concentrates are being shipped to Singapore.

The Tin Council will hold the spotlight in 1958, an unenviable position. The organization will be under tremendous pressure during the coming year. Can the Agreement's producing countries, with their economies so dependent on sale of tin, afford another production cutback? How well the Agreement can stand up under the pressures of a dwindling market poses the major problem for tin sellers in 1958. The consumer will provide all the answers in the next 12 months•

Uranium

James W. Franklin
Associate Editor

SPECTACULAR is one way of describing both domestic and Free World uranium activity in 1957. The U.S. contracted for 11 new mills, more than doubling the capacity of our present 14 mills; ore reserves rose sharply—the same can be said for Canadian developments, for South Africa and for Australia. U.S. yellow cake production will hit 15,000 tons a year when all mills are onstream. The same figure is true in Canada. By 1959, the Free World uranium potential will be 40,000 tons per year.

Free World Milling Capacity

(Estimated tpd)

	1959	1957
U. S.....	20,740	**10,000**
Canada.....	44,350	**25,000**
South Africa.....	61,500	**61,500**
Australia.....	1,000	**900**
Belgian Congo.....		**1,000**

So fast has the industry grown that it has outstripped the market, which at present is only a defense one. Such was the situation that prompted the now famous Oct. 28 pronouncement—"We have arrived at the point where it is no longer in the interest of the Government to expand production of uranium concentrates."

The U.S. will build no more mills, except in hardship cases where little or no milling capacity exists. And if new mills are granted in fringe areas, they most likely will be in the 200 tpd category.

Some millers' contracts expired recently and were renewed, but at a lower production figure. The AEC is talking about 15,000 annual tons of concentrate production after 1958, but the presently contracted mills have a capacity in excess of that amount in 1958. It has been intimated that some millers will have their contracts trimmed, and that

U. S. Uranium Mills, Location and Size

Company		Capacity in tpd 0.25% ore
Rifle, Colo.	Union Carbide Nuclear	280*
Uravan, Colo.	Union Carbide Nuclear	1,100
Durango, Colo.	Vanadium Corp.	430
Naturita, Colo.	Vanadium Corp.	350
Grand Junction, Colo.	Climax Uranium Co.	350
Shiprock, N. M.	Kerr McGee Oil	500
Grants, N. M.	Anaconda Co.	3,000
Salt Lake City, Utah	Vitro Uranium Co.	550
Monticello, Utah	Government mill	600
Edgemont, S. D.	Mines Development	300
Tuba City, Ariz.	Rare Metals Corp.	250
Moab, Utah	Uranium Reduction Co.	1,500
Split Rock, Wyo.	Western Nuclear Corp.	400
Ford, Wash.	Dawn Mining Co.	400
Mexican Hat, Utah	Texas-Zinc Minerals Co.	775**
Rifle, Colo.	Union Carbide Nuclear	1,000**
Maybell, Colo.	Trace Elements Corp.	300**
Gunnison, Colo.	Gunnison Mining Co.	200**
Fremont, Wyo.	Lucky Mc Uranium Corp.	750**
Grants, N. M.	Homestake-New Mexico Part.	750**
Grants, N. M.	Homestake-Sapin Partners	1,500**
Grants, N. M.	Kermac Nuclear Fuels	3,300**
Grants, N. M.	Phillips Petroleum Co.	1,725**
Lakeview, Ore.	Lakeview Mining Co.	210**
Riverton, Wyo.	Fremont Minerals Co.	500**
Total		20,740***

*To be replaced by new Rifle mill.

**Under construction in 1957 or announced.

***Total corrected to eliminate first Rifle mill.

some will not get a renewal when present contracts expire.

Since the AEC has made mention several times of the 500 annual ton limit for a mining property, it appears likely that those mills having more than 500 tons production (700 to 800 tpd ore) will be the ones to feel the slash.

On the foreign scene, the U.S. says that it is now purchasing about 80% of the Free World production. It will not contract for any more foreign concentrate. It has made no commitments overseas in the past several years.

With the Oct. 28 announcement—now firmly implanted in the minds of the small western miner along with Black Tuesday and the 18th Amendment—the small miner was caught unprepared; many unwilling to believe what they had just heard—that we have a temporary oversupply of uranium concentrates. Many have already experienced a reaction to the statement—cut back of their mill purchases, particularly for those with low-grade ore (less than 0.25% U_3O_8).

It came as a surprise to many that Circular 5 applies only to limited quantities of ore delivered at Monticello. All the private millers have the right to say from whom, where, when and at what grade ore will be accepted. And most small miners do not even have a smelter contract. They simply drive up with a truckload and sell it.

Most of the milling companies do not seem outwardly disturbed by the slowdown, since they have a guaranteed contract and price for a limited amount of production for the next nine years.

Why did the AEC put on the brakes? We have more uranium than we expect to use in the next few years. A civilian market will develop in the next ten years, but at a much more conservative rate. They're now talking about 10,000 to 13,000 tons consumption after 1966, if the reactor power costs can be dropped to 10 mills.

However, if we cannot get the cost down under 15 mills, the same experts say that we will need only about 3,000 tons a year to satisfy the civilian power program—a far cry from earlier 50- to 100,000 annual ton estimates.

U.S. ore reserves rose to more than 75-million tons, 0.27% U_3O_8 although operators in the Riverton, Wyo. area feel that the AEC's estimates are low. We had 14 mills operating in 1957, and contracted for 11 more, of whose total milling capacity will be greater than the 14 now running.

Nearly 3-million tons of ore were mined and milled at an annual average rate of 10,000 tpd. Production is estimated at 8,400 tons of concentrate, since the first half year production was 4,141 tons.

In 1959, U.S. will have 24 operating mills, totally 20,500-tpd capacity. Ore production will have to be in the neighborhood of 7-million tons to feed those mills. Production will be about 15,000 tons of concentrate.

Canadian production will come from 25 mines feeding 19 mills in 1958. Concentrate production in the first half of 1957 was reported at 2,235 tons, and is estimated at 6,000 to 6,900 tons for the full year. Canadian reserves are tremendous—officially set at 320-millon tons, 0.12% U_3O_8. However, miners in the Blind River area insist that Blind River reserves are in excess of 500-million tons alone.

Present Canadian milling capacity is about 32,350 tpd. It will rise to 44,350 tpd by 1959 when all current construction goes onstream. In 1959, Canadian production will be about 15,000 tons of concentrate a year.

South African uranium is being produced from 29 gold-uranium mines with 17 mills at approximately 20-millions of ore per year. In 1958-59, the Union will turn out some 61,500 tpd ore. Concentrate production in 1957 is estimated at 5,500 tons, based on a reported 2,650 tons for the first half. Production will be about 6,000 tons annually in 1958.

Ore reserves in the Union are set at 1.1-billion tons, 0.03% U_3O_8.

Australian production at present comes from two mills—the federal government-owned Rum Jungle and South Australia State's Radium Hill. Rio Tinto Co.'s Mary Kathleen mill will go onstream in 1958.

Rum Jungle ore reserves are 335,000 tons, 0.3% U_3O_8. Reserves feeding the other two mills are not available.

Milling capacity at Rum Jungle is about 10,000 tpm producing an estimated 595,000 lb of yellow cake in 1957. Radium Hill's capacity is about 450,000 lb per year—totaling about 522.5 tons for the two. After 1958, when Mary Kathleen comes into production, output is expected to climb to 1,000 annual tons of concentrate.

Others. France has an estimated

Free World Uranium Ore Production

(Millions of tons per year)

	1959 estimated	1957 estimated	1956
U. S.	7	3	3
Canada	13	6	2
South Africa	20	20	20
Australia	0.35	0.15	0.1*

*Rum Jungle only.

South African Uranium Mills

	Capacity in tons per month of 0.033% ore
West Rand Cons.	70,000
Daggafontein	120,000
Blyvooruitzicht	160,000
Western Reefs	200,000
Stilfontein	180,000
Randfontein	150,000
Luipaards Vlei	50,000
Vogelstruisbult	40,000
President Steyn	150,000
Welkom	150,000
Harmony	80,000
Dominion Reefs	40,000
Virginia O.F.S.	130,000
Vaal Reefs	65,000
West Driefontein	80,000
Hartebeestfontein	100,000
Buffelsfontein	100,000
Total	1,730,000 tons

Canadian Uranium Mills

	Capacity in tpd of 0.12% ore (for most mills)
Beaverlodge	
Lorado Uranium	500
Uranium City	
Eldorado Mining & Refining	2,000
Bancroft	
Bicroft Uranium	1,000
Faraday Uranium	1,000
Canadian Dyno Mines	1,000*
Port Radium	
Eldorado M&R Co.	200
Yellowknife	
Rayrock Uranium	150
La Ronge	
Gunnar Uranium	1,250
Blind River	
Pronto Uranium	1,500
Algom Nordic	3,000
Algom Quirke	3,000
Cons. Denison	6,000
Northspan's Lake Nordic	4,000
Northspan's Panel Cons.	3,000*
Northspan's Spanish American	2,000*
Can-Met Explorations	3,000
Stanleigh Uranium	3,000
Stanrock Uranium	3,000*
Milliken Lakes Uranium	3,000*
Total	44,350 tpd

*Due onstream in 1958.

Free World Concentrate Production

(Tons per year)

	1959 estimated	1957 estimated	1956
U. S.	15,000	8,400	6,000
Canada	15,000	6,000	2,200
South Africa	6,000	5,500	4,400
Australia	1,000	522.5	271*
France	1,000	300	
Rhodesia		370	
Belgian Congo	600	1- to 3,000	

*Rum Jungle only.

Free World Uranium Reserves

(Millions of tons)

	1957 estimated	1956 estimated
U. S.	75	60 (0.27%)
Canada	320	225 (0.12%)
South Africa	1,100	1,100 (0.03%)
Australia	0.335 (0.3%)*	
France	0.1 (0.2%)	
Italy	3 (0.2%)	
Belgian Congo	unpublished	

*At Rum Jungle only.

100,000 tons, 0.2% U_3O_8 reserves and is producing an estimated 300 tons of concentrate a year in 1957. Between 1959 and 1961, France expects to have a production capacity of 1,000 annual tons a year.

Italy has no production facilities at this time, but ore reserves in the Alps are estimated at 3-million tons, 0.2% U_3O_8.

Belgian Congo does not make production figures available, but it is known that Congo milling facilities have a capacity of 25,000 tons of ore per month—somewhere between 1,000 and 3,000 tons concentrate per year. Production is expected, in some quarters, to drop to about 600 annual tons in the future.

Rhodesian production in 1957 was 300 tons.

USSR is believed to be producing at 6,000 annual ton rate.

Price. Concentrate purchase price is $8 a lb per contained U_3O_8, but since there are many old contracts still in force, the average price is much higher. For fiscal 1956, the domestic price was an average $11.60 (foreign—$10.90). In fiscal 1957, domestic price was down to $10.50, while foreign increased to $11.15. In fiscal 1958, domestic price is expected to drop even further—to $9.60, while foreign price remains at $11.15. In fiscal 1959, the domestic price will be down to $9.30 and foreign down to $10.70 a lb.

Outlook. The market for the next few years will be a military one. No new foreign commitments will be made by the U.S. No new domestic mills will be built, except possibly in fringe areas. Some millers may get more particular about what and whose custom ore they take—others will have to take anything they can get.

Exploration will probably suffer from the change in policy. While we have only enough reserves to handle present milling capacity for the next ten years in the U.S., few, if any, of the 725 miners are in a position to explore for ore they cannot hope to sell. However, there is one condition which might be exploited to keep exploration going. The U.S. has no uranium stockpile other than weapons and 1.5-million tons of ore at buying stations. We do not have, as we do have in almost every other commodity, a stockpile of ore, concentrate, green salt, hexafluoride or uranium metal. The Commission is open to industry suggestions on how to keep exploration at its present peak.

Looking toward 1966, watch for a change in AEC's uranium policy toward a greater degree of regulated free enterprise. In the next few years, we may well see an integrated producer entering the field with the necessary facilities to mine, mill, refine, fabricate, generate power and reprocess the fuel.

Competition. Fusion does not appear to be a dangerous competitor for uranium nuclear fission at the present time. If and when the fusion reaction becomes practical, it will have to compete, not only with oil, gas and coal as a source of energy, but with a firmly established uranium industry. And fusion's capital costs appear to be fantastic alongside the very high costs of uranium reactors.

Thorium and the breeder reactor may have an important place in the energy field as a competitor to uranium. This is most particularly true outside the U.S., because the U.S. is the only Free World nation capable of producing the enriched uranium needed for reactors other than the breeder. The other nations will have to spend huge amounts of capital to build their own Savannah Rivers, or buy the enriched fuel from the U.S., or, as is most likely, develop the breeder reactor to produce their own enriched uranium•

Titanium

Daniel P. Eigo
Managing Editor

IN EARLY 1957, the U. S. Government cut back its defense needs for aircraft, and titanium metal lost almost all of its major market.

Producers of sponge and mill products found themselves with large capacity, a steadily improved product, and a very small market to absorb their 1957 sponge production, estimated at 16,000 tons for the U.S. and 17,500 for the Free World.

At the beginning of the year, according to Prof. Herbert H. Kellogg, of Columbia University, "about two-thirds of the titanium market was in one basket—the B-52 bomber program." The cut-back B-52, and its eight J-57 engines, used more than any previous military aircraft. About 12% of U.S. production went into civilian uses in 1957, including civilian aircraft, and the remainder into other Government and military fields. Mill products are permitted in a revolving stockpile, and some production was taken to fill Government contracts, in which the U.S. requested expanded production and then the producer found no market.

Even with the current strong pressure on Congress to expand the defense budget, most observers doubt that the bomber program will be reinstituted. Missiles, the current pride of the defense establishment, do not seem to be more than modest users of titanium.

Industry and Government are awaiting a report by the Battelle Memorial Institute on the latter problem, due to be published soon. Entitled, "Criteria for Selection of Materials for Guided Missile Design," it represents research into the whole field of missile materials with, presumably, some recommendations of various metals for the Defense Department program. But even its best friends do not believe that titanium will be mentioned in "Criteria" in any manner which would spur volume consumption on the order of the B-52 program.

Civilian use, if non-military aircraft is excluded, has never been high. Even during the peak of titanium's production and demand, when Government permitted 10% of U.S. mill product output to be made available for civilian use, demand never was as high as 5%. Non-military planes may purchase mill products through defense-rated orders since they have an "emergency" potential in wartime, and thus are not included in the "civilian" list.

Industry looks to non-military aircraft for a major market. Already the DC-7 takes some 800 lb of products and the Boeing 707, DC-8, Electra, Convair 880 and the Bristol Britannia take comparable amounts.

In September, BDSA reduced the required acceptance of defense-rated orders by producers from 90% to 75% of scheduled production "to encourage greater use of titanium mill products in non-defense applications."

Brightest news on the civilian application front was made by Titanium Metals Corporation of America when it received what is believed to be one of the largest industrial orders for specially fabricated titanium in history. Freeport Sulphur Co. ordered seven miles of seamless titanium pressure tubing, to be used in heat exchangers for processing nickel and cobalt at the company's new mine at Moa Bay, Cuba.

Total sponge consumption in 1957 is estimated by Jesse A. Miller, commodity specialist, and Frank J. Cservenyak, chief, branch of light metals, USBM, at 8,500 short tons. Much of the excess sponge production was delivered to GSA under the terms of Government contracts. Cservenyak reports that deliveries, Jan. 1 to Nov. 1, totaled 8,305 tons, for a cumulative stockpile total of 17,594. Total consumption in 1956 was about 10,936 tons.

Sponge producers included, according to USBM: Cramet, Inc., Chattanooga, Tenn.; Dow Chemical Co., Midland, Mich.; Electro Metallurgical Co., division of Union Carbide Corp., Ashtabula, Ohio; E. I. du Pont de Nemours & Co., Inc., Newport, Del.; and Titanium Metals Corporation of America, (TMCA) Henderson, Nev. Foreign commercial producers included Osaka Titanium Manufacturing Co., Toho Titanium Industry Co., Ltd. and Nippon Soda Co. in Japan; and Imperial Chemical Industries, Ltd. and McKechnie Brothers, Ltd., in Britain.

Industry melters in 1957 included, TMCA at Henderson; Harvey Aluminum, Torrance, Calif.; Mallory-Sharon Metals Corp., Niles, Ohio; Rem-Cru Titanium, Inc., Midland, Pa.; Republic Steel Corp., Massillon and Canton, Ohio; and Oregon Metallurgical Corp., Albany, Ore. Latter melted sponge to make ingot and castings while the other companies produced and processed ingots into mill products. Rem-Cru announced production of 7,200-lb ingots at Midland, measuring 32 in. dia and 5 ft high. In November, Crucible Steel became full owner of Rem-Cru through a stock payment to Remington Arms for its half interest.

TMCA opened the nation's first integrated plant at Toronto, Ohio for rolling and forging titanium. Highly instrumented equipment designed or modified solely for the metal's problem characteristics was expected, TMCA said, to reduce metal loss, one of the more costly factors in production.

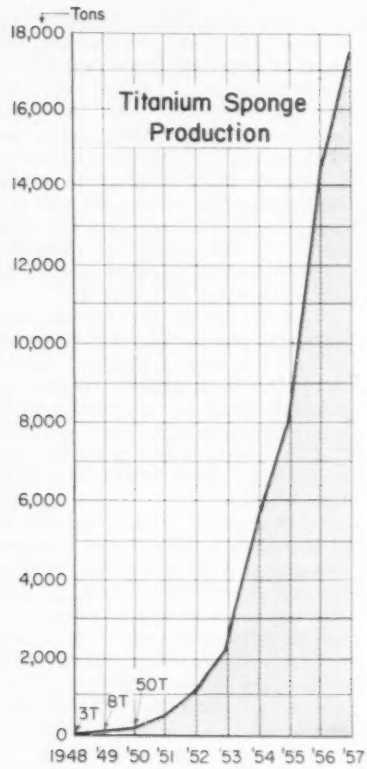
In September, Mallory-Sharon Titanium Corp. combined with National Distillers & Chemical Corp. to form Mallory-Sharon Metals Corp. The former has produced mill products from melted sponge for years. Combination with National Distillers' sponge plant (due in the second quarter of 1958) will make it, like TMCA, an integrated producer.

Electro Metallurgical Co.'s plant at Ashtabula, with a rated annual capacity of 7,500 tons sponge, announced operation at full capacity in January. Plant is the first in the U.S. to produce commercial sponge by the sodium reduction method rather than by magnesium reduction and is largest in the world. In November, Electro Met cut to 25% of capacity when Government announced that stockpile purchases would be discontinued after Feb. 4, 1958. Company, according to M. J. Leroy, plant superintendent at Ashtabula, plans to stretch out production rather than shut down operations. All other producers have cut production drastically, and some other producers like Dow Chemical, are on standby.

Allied Kennecott Titanium (Allied Chemical and Kennecott Copper) is continuing its program for construction of a $40-million titanium dioxide refinery at Wilmington, N. C. However, industry observers believe that even on completion of engineering drawings and plans, there will be a stretch-out pending a stronger market for the product.

Another TiO_2 refinery is planned in Finland by Vuorikemia Inc., a combination of five Finnish mining, power and chemical companies.

Harvey Aluminum notes that production facilities have been expanded for alloy ingot billet forging, and that the firm assisted in developing air-



plane and engine programs which use extruded shapes to avoid machining round and bar stock.

Stauffer Chemical Co. research on a new process (*E&MJ*, February 1957, p 92) "had been brought to the semi-works stage at the end of 1957." But, the firm says, further development has been slowed because of the depressed market for the metal.

New Jersey Zinc Co. says the company "has continued its work on the direct electrolytic production of titanium sponge and expects, during 1958, to operate a large prototype cell."

National Research Corp. has been continuing its drive toward better melting, alloying and metal fabrication, with particular emphasis on castings. The firm reports that one highlight of 1957 was perfection of the shape casting process so that "repeatable, radiographically sound castings of fairly intricate shapes can now be made with good surface conditions using inexpensive, expendable mold material." NRC also built and operated a sponge reduction plant at Newton, Mass. for GSA and has started work on design and construction of a new titanium skull melting furnace of large capacity for GSA which will incorporate new safety features, "as well as the capability of reprocessing scrap titanium."

U.S. ilmenite production is estimated by USBM at 4% over 1956, or 710,000 short tons. Cyanamid in Virginia; du Pont at Starke and Lawtey, Fla.; Marine Minerals Div. of Heavy Minerals Co., Clearwater, S.C., Metal and Thermit Corp., Beaver Dam, Va.; Rutile Mining Co., Jacksonville, Fla.; Florida Minerals Co., Wabasso, Fla.; and National Lead, at Tahawus, N.Y. were producers. A USBM survey of resources of the National Lead operation showed 121.5-million tons of titanium-bearing ore in the Tahawus area. Roughly 100-million tons of the total can be handled by present-day techniques, according to Jesse A. Miller, who made the survey.

Metal and Thermit formally opened the Beaver Dam property in November. Plant has planned capacity of 5,000 short tons of rutile per year.

Domestic rutile production is estimated by the Bureau at 11,800 tons, slightly under 1956. Output was from Marine Minerals, Metal and Thermit, Florida Minerals and Rutile Mining Co. Du Pont recovers rutile, but as a residue, not a finished product.

Du Pont announced it would take over the operation of the Starke and Lawtey operations from Humphreys Gold, which had been operating the facilities under a 10-year lease. Output will be curtailed.

Union Carbide started construction at a deposit on Amelia Is., Fla. A 500 tph dredge, and a wet and dry mill will treat the beach sands. (See the Mines, Mills and Smelters section of this issue for other projects.)

QIT, at Sorel, announced expansion of titanium dioxide slag by 60% with addition of three new ilmenite smelting furnaces.

Imports of ilmenite for the first nine months of 1957 were 352,488 tons of concentrate, according to Miller and Cservenyak. Rutile set an all-time high for the same period with 66,083, compared with 48,906 for all of the previous year. Some 3,266 tons of sponge metal were brought in from Japan (3,152), U.K. and Canada, mostly under barter agreements.

Ore prices held for ilmenite according to *E&MJ Metal and Mineral Markets*, at $26.26 to $30.00 for the year. Rutile, according to the same source, dropped from $190 to $230 per short ton at the beginning of 1957 to $120 to $125 at year end. Australian producers felt the market drop keenly and a number of mines faced closure.

Price cuts in sponge and mill products rank high among producers and industry observers as one of the few cheering facts of 1957. Grade A-1 sponge went from $2.75 to $2.25 per lb on June 3; A-2 from $2.50 to $2.

Mill product prices have also gone down regularly. TMCA reports composite prices (sheet, strip, alloy bar and alloy billet) have gone from $15.25 in April 1954, to $10.55 in June 1957. These cuts, in the face of a declining market, rank as one of the most important highlights of the year.

Research, as indicated by companies reporting to *E&MJ*, is going ahead despite the cuts in demand. But, to paraphrase Thomas W. Lippert, director of marketing, TMCA, "You can't divorce quantity from price"—nor can you divorce research from volume sales. Lippert was discussing the possibility of further price cuts in a declining market, but the same conditions apply to the problem of talking stockholders into a large research budget for new markets when the market won't support current output.

But, all producers and industry observers agree, prices must be cut. They all agree that the cuts will come, and that research must also be directed toward broadening markets. Titanium alloys, with increased research, may prove useful in the range of 1,600 to 2,000 deg F., according to Fountain and Janke; titanium castings are also one of the favorite bets of producers and researchers. Corrosion resistance of the metal is also a very strong point that has yet to be fully promoted.

Convair Division of General Dynamics was awarded an Air Force contract of $1.3-million to study use of newer titanium alloys in future supersonic aircraft and missiles. The 18-month study is to start in early 1958. One of the industry's latest blows came when the contract for the new "chemical bomber" went to North American Aviation's plane (which uses a comparatively small amount of titanium) and not to Boeing's WS110A which used large amounts.

Uniformity and general quality of sponge and mill products have increased as steadily as prices have declined, and the industry is sworn to continue the two efforts to the hilt.

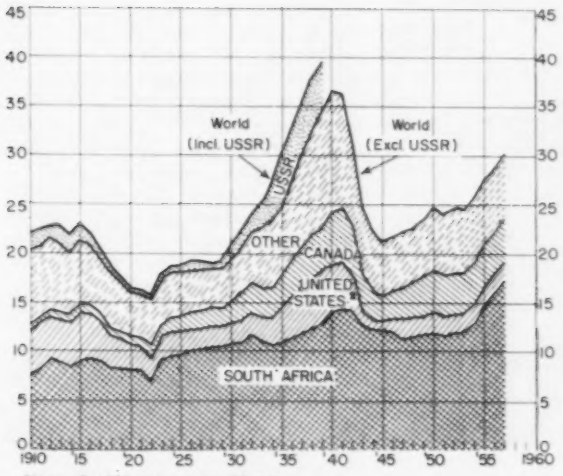
Typical of the improvements being made by research is the announcement by TMCA in January 1958 that it will guarantee and certify oxygen content in the most widely-used alloy grade metal in bar and billet form.

Research on scrap recovery also got a shot in the arm when Mallory-Sharon announced a $500,000 pilot plant to separate alloy material. The industry has long suffered with the problem of contamination of scrap

(*Continued on p 166*)

I—World Gold Production

(Millions of fine oz)



Note: all 1957 data are provisional.
*Including Philippines through 1939.

	1957*	1956	1955	1954	1945	1940
North America:						
Canada	**4.4**	4.4	4.5	4.4	2.7	5.3
United States	**1.8**	1.9	1.9	1.9	0.9	4.9
Latin America:						
Mexico	**0.4**	0.4	0.4	0.4	0.5	0.9
Colombia	**0.3**	0.4	0.4	0.4	0.5	0.6
Chile	**0.1**	0.1	0.1	0.1	0.2	0.3
Nicaragua	**0.2**	0.2	0.2	0.2	0.2	0.2
Africa:						
Union of South Africa	**17.2**	15.9	14.6	13.2	12.2	14.0
Ghana	**0.8**	0.6	0.7	0.8	0.5	0.9
Southern Rhodesia	**0.5**	0.5	0.5	0.5	0.6	0.8
Belgian Congo	**0.5**	0.4	0.4	0.4	0.3	0.6
Asia:						
India	**0.2**	0.2	0.2	0.2	0.2	0.3
Philippines	**0.4**	0.4	0.4	0.4	—	1.1
Australia	**1.1**	1.0	1.1	1.1	0.7	1.6
Total	**27.9**	26.3	25.4	24.0	19.5	31.6
Other, excluding USSR	**2.1**	2.1	2.1	2.1	1.6	5.1
World, excluding USSR	**30.0**	28.4	27.5	26.1	21.1	36.7

*Tentative figures based on preliminary data.
Note: Figures may not add up to totals because of rounding.

Gold

Dr. M. A. Kriz*
Federal Reserve Bank of N. Y.

THE YEAR 1957 was marked by three principal gold developments. First, world gold output rose by some 1.6-million oz; this was the fourth consecutive sizable increase and, even more significant, it was about 80% larger than in 1956. Second, as much gold seems to have flowed into official monetary stocks as in 1956, and prices for bar gold on the international gold markets outside the U. S. remained close to $35 per oz; the adverse international political events and the inflationary pressures and balance-of-payment strains in many countries therefore did not touch off any notable increase of hoarding demand. Third, the serious payments difficulties experienced by many foreign countries brought about a reversal in the build-up of gold and dollar holdings of foreign countries that had begun in 1952.

At the year-turn, there was much concern over the impact on international trade and payments of gold and dollar losses of many foreign countries. To be sure, a decline in international reserves consequent upon a fall in aggregate U. S. payments to foreign countries relative to its receipts from them would have adverse economic and financial repercussions throughout much of the Free World. Last year's international payments difficulties did not, however, originate in any such decline; indeed, payments by the U. S. to foreign countries rose still higher in 1957—for the fourth successive year. Furthermore, the loss of gold and dollars by foreign countries to the U.S. equals less than 2.5% of the aggregate gold and dollar holdings, which have more than doubled during the past 10 years.

Viewed in this perspective, such a loss to the U.S. could hardly have had marked overall effect on international liquidity. In the world today, however, the dollar is a reserve currency and is used for settling balances not only with the U.S. but also among the foreign countries themselves. Global external payment deficits requiring settlement in U.S. dollars—as well as in gold—resulted in 1957 in particularly large gold and dollar losses by such countries as the U.K., France and the Netherlands; the counterpart of these losses were the substantial gold and dollar gains of the Federal Republic of Germany. A number of special factors aggravated, of course, the payments difficulties of particular countries, but the fundamental cause almost everywhere was the inflation generated by the pervasive demand for goods in excess of available resources. The inflationary demand, together with the cost-push effects of rising prices and wages and the doubts raised about the continued maintenance of reasonable monetary stability, inevitably led to heavy over-importing, inhibited exporting, induced capital outflows, and thus brought about drains on gold and dollar reserves. As the year passed, however, many countries succeeded in restraining excessive demand at home, and thus reduced imports, helped promote exports, and strengthened the confidence in the currency. This, together with the greatly increased strength of many economies over only a few years ago, was pointing at the year-end to the conclusion that the principal trading nations would be able to restore a workable economic balance, at home as well as in foreign trade and payments. At the same time, the earlier rate of economic expansion slowed down throughout much of the Free World and the question was thus coming up in many countries when, and subject to what safeguards against an inflationary relapse, an increase in monetary demand could be safely allowed in order to sustain a steady and balanced economic growth.

World production (excluding USSR) amounted last year to some 30-million fine oz or about 1.6-million more than in 1956 (see table), on the

*The author is chief of the Foreign Research Division of the Federal Reserve Bank of New York. The views expressed are, of course, his own and are not meant to reflect those of the bank.

basis of preliminary or incomplete data available at year-end. Last year's rise was, therefore, about 80% larger than the 0.9-million increase in 1956 and 0.2-million oz larger than the increases of 1.4-million in 1953 and in 1954, which followed a period of relative stability of world gold output from 1950 through 1953. World output thus expanded last year at the rate of about 6%, as against 4 to 5% in each of the years from 1954 to 1956 and mere 2.5% annually from 1945 to 1953. Last year's output was 9-million oz above the 1945 postwar low and 6.7-million oz short of the 1940 all-time peak (see chart I).

The 1.6-million oz rise in last year's output was due mainly to an increase in South African production. At some 17.2 million oz—the highest ever recorded—South Africa's output in 1957 was 1.3-million or 8% above 1956; it also was nearly 3-million oz above 1941, which was the record year that had marked the culmination of the last previous expansion phase.

The current rise in the South African output, which began in 1953, had resulted by 1957 in an expansion of output by 45%. As in the earlier years, the 1957 rise was attributable principally to the continuing increase in the output of the new mines of the Orange Free State and the Far Western Rand extensions of the Transvaal. Indeed, the production of these new mines increased from less than 0.5-million oz in 1953 to 1.1-million in 1954, 2.2-million in 1955, 3.1-million in 1956, and probably 3.8-million in 1957; toward the year-end it was equal to nearly 33% of the production of the Transvaal, which comprises mainly the older mines. Output of the new mines is expected to expand further over the coming years; on the other hand, the production of the Transvaal mines, which began to rise in 1952 after a decline during the war and the earlier postwar years, remained stationary in 1956-57. In mid-1957, it was announced that a mining lease had been granted to open up the first so-called "ultradeep mine"; in this project, mining is to start at a depth of 5500 ft and ultimately go as far down as 12,500 feet. Milling from this mine is expected to start in six or seven years.

Total output of all the other producing countries (excluding the USSR) increased last year by some 0.3-million oz. This was attributable principally to the growth in the output of Ghana and the Belgian Congo; elsewhere, production on the whole remained stationary. In Canada, last year's output was about 4.4-million oz; at this level, it was nevertheless

II—Dollar Equivalent of London Gold Price

(Monthly averages)

only about 15% below the all-time peak of 1941. A growing portion of Canadian gold is derived as a by-product from base-metal mining, which has expanded rapidly in the various new and old areas. In the U. S., gold production was about 1.8-million oz (on the basis of the first 10 months) or slightly less than in earlier years. In Australia, India, the Philippines, Southern Rhodesia, and Latin America, production generally showed no changes. No data are, of course, available for the USSR, probably the world's second largest producer.

Mining costs continued to rise last year. In South Africa, the average working costs per ton of ore milled reached the equivalent of $6.37 in the third quarter of 1957 or 6% higher than in the corresponding period of 1956; they had been at $4.14 in 1950, the year following the devaluation of the pound. Measured per ounce of gold produced, however, the cost actually declined by about 5% — to $25.08 in the third quarter of 1957, against the average of $26.25 during the corresponding period of 1956 (in 1950, it had stood at $22.01); this was largely attributable to the increase in the gold yield in the Orange Free State mines. Mainly for this reason, the average working revenue and profits continued to develop favorably last year. Working profits per ton of ore milled rose to $2.59 during July-September, the best since 1951. In absolute amount, total working profits from gold mining during the first nine months of 1957 were $121-million; compared with the profits of $136-million made during the entire year of 1956 and of $144-million in the peak year of 1950. Expansion in the volume of output thus enabled the industry to offset the effect of the production cost rise on its profits. In addition, the industry has, since 1953, derived sizable profits from the expanding production of uranium, which in South Africa is obtained as a by-product of gold mining; during the first nine months of 1957, such profits totaled $68-million or more than 55% of the working profits from gold.

These aggregates for the industry as a whole obscure the highly uneven results of the mines in the rich new area of the Orange Free State and of the older mines on the Rand. In the new mines, the effect of the rise in costs was more than offset by increases in working revenue brought about by the mining of higher-grade ores; on the other hand, the old mines, owing to the absence of higher-grade ore, were unable to raise the grade of the ore mined and thus preserve a reasonable margin of profit. There was much discussion in South Africa regarding the problem whether these so-called "vulnerable mines" should be kept in production beyond their economic limit in view of the impact of their closure on local economies or whether the industry should move from such mines as they become exhausted and press on with the developments of the richer new areas.

In Canada, costs likewise continued to rise; this caused some mines to turn to higher-grade ores and others to shut down. Emergency assistance to gold mines, which was first granted in 1948 and has been renewed several times, was extended in 1956 to cover 1957 and 1958. As in earlier years, all mines eligible for subsidy elected to channel their output into official reserves—a requisite for receiving subsidies—rather than sell on the Canadian free gold market, which was established in March 1956, or on the free markets elsewhere. During 1957, the Canadian dollar stood at a premium relative to the U. S. dollar; the highest premium of some 6% at which it stood in August brought the Canadian gold price to about Canadian $33.00 per oz, but toward the year-end the premium fell to somewhat over 1% and the gold price in terms of the Canadian dollar rose accordingly.

Assistance was also granted in the form of subsidies to producers in Australia, Colombia, and the Philippines. As in Canada, such subsidization has been designed to benefit marginal producers, the amount of subsidy being related to the presumed economic needs of various categories

of mines and subject to various conditions. Australia in September 1957 increased the rates of assistance to the gold producers, while maintaining the basic structure of the subsidy scheme. The International Monetary Fund, according to its announced policy, has "a responsibility to see that the gold policies of its members do not undermine or threaten to undermine exchange stability"; consequently, Fund members that propose to introduce or modify gold subsidies are under obligation to consult with the Fund on the specific measures.

International flow. The value of last year's gold output outside the USSR, at the official U. S. price of $35 per fine oz, was about $1,050-million. In addition, the USSR was reported to have sold during the year, in Continental Western Europe or in the London gold market, amounts of gold estimated in various quarters at over $200-million (in 1956, such sales were put at $150-million, and in each of the three preceding years at $75-million). New gold output outside the USSR with Russia's gold sales to the rest of the world amounted therefore to over $1,250-million.

Of this gold supply, some $675-million—or somewhat over one half—was added to the monetary gold reserves of central banks and governments and international financial institutions; $660-million and $490-million had thus been added in 1955 and 1956. The remainder went into industrial and professional uses or was absorbed by private hoarding demand. Allowing for industrial consumption of gold, which is generally estimated at over $200-million a year, the amount of gold that "disappeared" into private hoards last year may therefore have been of the order of $400-million. In Western Europe, private hoarding demand, which was dormant on the whole during 1954 and 1955, revived after the outbreak of the Middle Eastern crisis in 1956 and remained active during 1957, in large part as the result of the uncertainties regarding domestic conditions in France; by comparison with the waves of hoarding during the immediate postwar years and in 1950-51, however, the hoarding demand in Europe was small. In the Middle and Far East, private demand for gold was apparently fairly large at various times during the past year, especially in India; but in these parts of the world gold is used as an active means of payment, and the persistent absorption of gold cannot be regarded as primarily an evidence of hoarding.

The U. S. monetary gold stock at the end of 1957 was $799-million higher than a year previous. During January-September—the period for which full data have been published at this writing—it increased by $701-million, of which $79-million (net) was purchased from other countries and $600-million from the International Monetary Fund. In the year 1956, the U. S. purchased $80-million worth of gold from foreign countries and $200-million from the International Monetary Fund; these were the first net purchases for any extensive period since 1952.

Countries outside the U. S. added to their monetary stocks chiefly by purchases from new production. The bulk of the newly-mined gold was disposed of through the London gold market. South Africa, which produces some 80% of the sterling area's gold output, sold in 1957, as in the previous two or three years, most of its newly-mined gold in London. South Africa has no commitment to sell gold there but, according to an official South African statement, "the maximum use" is made of the London market because, "having regard to the international nature and the leading position of the London market, it appears unlikely that a better price could normally be obtained elsewhere." In addition, London also received the sizable output of Ghana and Southern Rhodesia. Gold originating from various non-sterling-area countries was reportedly also sold in London.

Principal buyers in London were the central banks in Continental Western Europe. One reason for this was that these banks were able to purchase gold at a few cents below $35 to settle their indebtedness, vis-a-vis the European Payments Union, which at the debtor's option can be done either in dollars or in gold valued at $35. Some gold was also sold to private operators, especially in the Middle and Far East.

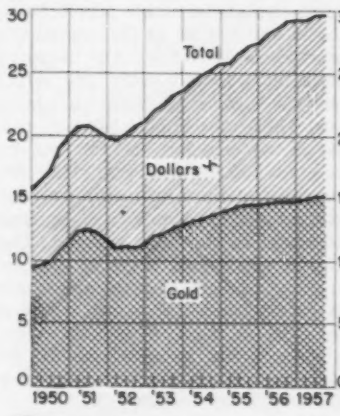
While sales of gold in London are unrestricted, purchases by British and other sterling area residents are subject to license, which is granted only for limited quantities of gold for trading and industrial purposes; residents of other countries may buy gold only if payment is made in American-account or Canadian-account sterling, which has always been fully convertible into dollars, or in the so-called registered sterling, which is issued only against dollars or gold itself, and which was established for this purpose at the reopening of the London gold market in March 1954.

As trading has developed in London, the London gold price has become increasingly important. The price generally moves with the sterling-dollar exchange rate. As in previous years, the dollar equivalent of the London gold price remained during most of last year within the range of the U. S. buying and selling prices of $34.9125 and $35.0875 ($35 plus or minus ¼%) at which the Federal Reserve Bank of New York, acting on

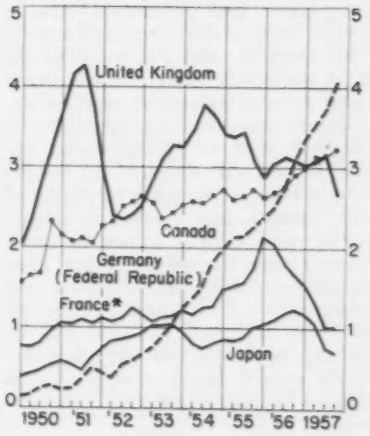
Gold and Dollar Holdings

(Billions of U.S. dollars)

III—Foreign Countries**



IV—Selected Countries



**Including the Bank for International Settlements and the European Payment Union; excluding other international institutions and, as regards gold, the USSR.

†Official and private short-term dollar holdings as reported by banks in the United States, and estimated holdings of United States Government securities having an original maturity of more than one year.

*Excludes gold holdings of French Exchange Stabilization Fund.

Source: Federal Reserve Bulletin.

behalf of the U. S. Treasury, deals with foreign monetary authorities (see chart II). Sellers thus received a higher price in London, and foreign monetary authorities found it cheaper to acquire gold in London than in New York to the extent, of course, that shipping costs did not enter in.

A noteworthy feature of last year's gold price developments was the decline in the dollar equivalent of the London price to $34.85 during the third week of January 1957[1], the lowest reported since the reopening of the London gold market in March 1954. This decline, which occurred shortly after the suspension of Suez hostilities, was reportedly brought about by a lack of demand for gold on the part of central banks as well as private operators; on the contrary, some central banks reportedly sold gold in London to obtain U. S. dollars. Subsequently, however, the price recovered steadily, reaching parity in late June. It fell again in August and September to as low as $34.95 at the end of September, and then fluctuated for the remainder of the year between $34.95 and $34.99; at the year-end, it stood again at $35.00. The range of quotation was thus only 15c (U.S.) last year, against as much as 23c in 1956. Unlike the Middle Eastern crisis that on two occasions in 1956 sent the price to $35.05, last year's international political and economic developments failed to cause any marked movement in the price of gold. The price at which gold is traded directly for U. S. dollars in foreign markets other than London remained within a few cents of the London gold price. In Zurich, for instance, the U. S. dollar price for bar gold moved very closely with the London price.

[1]Unless otherwise stated, all prices quoted in this article are approximate weekly averages.

In several markets where gold is traded in local currencies, the price for bar gold did not follow the London price, but at the same time did not deviate from it very much; this was, for instance, the case of Brussels, Milan, and Beirut. In Paris, however, the U. S. equivalent of the price of bar gold, as converted at the so-called "parallel" exchange rate for bank notes, rose from $36.25 at the end of 1956 (it had been quoted as low as $35.60 in January 1955) to $36.85 in mid-July; it subsequently declined to less than $36.50, and at the year-end stood at $36.20. In terms of the French franc, the Paris bar gold price fluctuated between 460,000 and 475,000 francs during the first half of the year, but rose during the second half to as much as 590,000 francs in late November; it stood at 553,000 francs at the year-end. This sharp rise is obscured in the U. S. dollar-equivalent price by the depreciation of the

(*Continued on p. 198*)

Silver

Francis H. Wemple
Handy & Harman

THE SILVER SITUATION in 1957 has been largely a repetition of 1956. The market continued to be dominated by the U. S. laws and the Treasury's policy under these laws. In New York the average price for 1957 was virtually the same as for 1956, and its fluctuations were just as limited. The high was 91⅜c per troy ounce and was in effect as the year started. It compares with the 1956 high of 91⅝c. The low for 1957, established on Dec. 17, was 89⅝c and compares with the previous year's low of 90c. Total range covered only 1¾c, compared with a spread of 1⅝c in 1956. These quotations refer to the published rate, which is the price paid in settlement for silver in unrefined silver bearing materials and is ¼c below the market price for refined bullion.

U. S. consumption of silver in the arts and industries during 1957 amounted to about 95-million ounces, which was 5% below the 1956 rate. Moderate declines in the amounts used in both the arts and industrial categories caused the drop, and industrial uses continued to account for substantially better than half of total U. S. silver consumption. In the arts most of the drop resulted from reduced production of silver plated ware, with sterling holding up to 1956 levels. In the industrial field, the number of applications of silver and silver alloys continued to increase, but the total amount of metal consumed was lower, due largely to the general decline in consumer durable goods. The significance of a stepped-up defense program cannot be evaluated as yet, but it is already apparent that there are new and growing uses of silver in the missile field and other advance weapons, together with their increasingly technical control mechanisms.

U.S. Trade in Silver

	1957 estimated	1956	1955
Imports:			
Canada	**17.7**	20.0	21.2
Mexico	**16.3**	18.9	21.5
Peru	**13.3**	11.4	10.9
Bolivia	**3.8**	5.5	3.0
Cuba	**.3**	.2	.4
Other	**4.6**	4.3	4.0
Total Western Hemisphere	**56.0**	60.3	61.0
United Kingdom	**22.3**	67.7	.1
Netherlands	**4.7**	19.3	16.8
Other European countries	**.1**	—	—
India	**82.1**	—	—
Pakistan	**30.3**	—	—
Australia	**1.6**	11.5	1.6
All other countries	**1.3**	4.0	5.0
Total imports	**198.4**	162.8	84.5
Exports:			
Mexico	**1.2**	1.7	1.5
United Kingdom	**3.9**	1.6	.6
Western Germany	**2.8**	.3	1.9
All other countries	**2.4**	1.9	.8
Total exports	**10.3**	5.5	4.8

A review of price developments during the year can be divided conveniently into three periods. For the first four months, January through April, demand was strong, not only from domestic industry but also from foreign buyers, and the published price in New York was firm at 91⅜c, which was based on the delivered cost of Treasury silver in the New York market. Producer's supplies, even including all domestic production, were inadequate on the average, and users in this country found it necessary to buy from the Treasury from time to time to fulfill their needs. Under the regulations, the sale of Treasury silver is restricted to domestic fabricators and may not be exported. Because of this, exportable silver sold at a premium over the New York price on occasion, as had happened before.

The situation changed rather markedly in May, beginning the second phase of the market's development, a period during which prices were sensitive to relatively minor changes in the balance between demand and supplies. Buying pressure from abroad subsided, and consumers here did not need the

supplies thereby released. On May 28 the price dropped by ½c to 90⅞c, and at this level domestic production refined on the West Coast could be delivered to the San Francisco Mint more economically than to the New York market. From May through October prices fluctuated around the 90½c Treasury buying price for domestic silver, the extent and degree of these fluctuations depending on how much domestic silver was needed by the market at any particular time. A modest seasonal improvement developed in midsummer but it was of short duration. Prices during August, for the last time in 1957, again reached a level sufficiently high to attract Far Western output.

The third phase of the market, starting around the middle of November and lasting through the end of the year, was a period of gradual easing during which virtually all domestic production went to the Mint. By Nov. 22 the published price had dropped to 90¼c and from this point on, domestic silver was no longer required. Subsequent declines carried the price to the year's low of 89⅝c on Dec. 17.

This outline of the market demonstrates anew the influence of U. S. silver laws on the price of silver. Last year the 84th Congress took no action on legislation providing for the repeal of existing silver purchase laws. Proponents for repeal, however, have renewed their efforts. On Jan. 3, Representative Sadlak introduced a bill, H.R. 448, and on Feb. 7 Representative Celler introduced a bill, H.R. 4562, in the House of Representatives, which were referred to the Committees on Banking and Currency, and Ways and Means, respectively. On Feb. 14, Senator Green introduced a bill, S. 1201, in the Senate, which was referred to the Committee on Banking and Currency. These bills provide for the repeal of all existing silver purchase legislation, including the transfer tax on profits made in trading.

Once again the return of lend-lease silver accounted for the major portion of silver imports during 1957. Of the total of 138.3-million oz of such silver received, about 21.2-million oz came from the United Kingdom, 4.7-million from the Netherlands, 82.1-million from India and from Pakistan about 30.3-million. Terms of the original lend-lease agreements provided for repayment of silver in kind within five years after the cessation of World War II. The signing of the Japanese Peace Treaty in April of 1952 officially brought hostilities to a close, and, accordingly, April of 1957 became the repayment date, subject to certain

World Silver Statistics

(Millions of oz)

Production:	**1957**	1956	1955	1954	1953
Mexico	**46.0**	43.1	48.0	39.9	47.9
United States	**37.5**	38.7	36.5	35.6	37.7
Canada	**24.2**	27.7	28.0	31.1	28.3
Peru	**23.0**	21.8	22.9	20.4	19.7
Bolivia	**7.0**	7.5	5.9	5.0	6.1
Other South and Central American countries	**7.0**	7.0	6.4	7.8	9.7
Total Western Hemisphere	**144.7**	145.8	147.7	139.8	149.4
Outside the Western Hemisphere	**78.0**	76.6	75.7	74.4	72.3
World production	**222.7**	222.4	223.4	214.2	221.7
Consumption:					
Arts and Industries:					
United States	**95.0**	100.0	100.0	85.0	105.0
Canada	**5.2**	4.5	4.6	3.9	4.7
Great Britain	**13.5**	13.2	14.2	12.6	11.9
France	**12.3**	12.0	15.7	15.0	14.5
Western Germany	**45.0**	40.8	28.1	24.2	11.9
India	**15.0**	17.5	3.0	3.0	4.0
Japan	**8.8**	8.0	6.2	5.8	5.6
Other countries	**15.0**	15.5	15.4	8.3	10.7
Total	**209.8**	211.5	187.2	157.8	168.3
Coinage:					
United States	**51.4**	31.1	8.2	53.2	42.8
Canada	**4.7**	2.8	.5	.9	3.8
Mexico	**3.1**	4.9	2.3	—	18.6
Saudi Arabia	**—**	—	17.2	—	—
Other countries	**20.0**	22.3	22.4	29.3	25.6
Total coinage	**79.2**	61.1	50.6	83.4	90.8
Total consumption	**289.0**	272.6	237.8	241.2	259.1

Treasury Silver

(Millions of oz)

	Dec. 31 1957	Dec. 31 1956	Dec. 31 1955	Dec. 31 1954	Dec. 31 1953
Held in Treasury:					
Securing Silver Certificates:					
Silver bullion	**1,711.5**	1,708.4	1,697.2	1,679.2	1,655.7
Silver dollars	**169.4**	182.8	196.1	207.0	215.2
Subsidiary coin	**6.0**	2.0	11.3	34.5	4.6
Free silver bullion	**127.4**	87.4	24.9	13.6	49.6
Total Treasury stocks	**2,014.3**	1,980.6	1,929.5	1,934.3	1,925.1
Outside the Treasury:					
Silver dollars	**208.3**	195.1	182.0	172.5	164.9
Subsidiary coin	**1,014.5**	968.0	928.3	898.9	877.5
Total silver outside the Treasury	**1,222.8**	1,163.1	1,110.3	1,071.4	1,042.4
Total silver	**3,237.1**	3,143.7	3,039.8	3,005.7	2,967.5

Silver Quotations

	New York price (Cents)			London spot (Pence)		
	High	Low	Average	High	Low	Average
1957	**91.375**	**89.625**	**90.820**	**80.500**	**77.125**	**78.927**
1956	91.625	90.000	90.826	81.375	76.625	79.132
1955	92.000	85.250	89.099	80.250	73.750	77.507
1954	85.250	85.250	85.250	74.375	72.000	73.482
1953	85.250	83.250	85.188	74.000	72.875	73.945
1952	88.000	82.750	84.941	77.000	72.500	74.360
1951	90.160	80.000	89.368	78.500	70.000	77.856
1950	80.000	71.750	74.169	70.000	63.000	64.796
1949	73.250	70.000	71.930	64.000	42.500	49.243
1948	77.500	70.000	74.361	47.000	42.500	45.004

provisions in the agreement for extensions. Arrangements for repayment have been completed in all cases except Saudi Arabia and Ethiopia. These two countries have availed themselves of the extension provisions.

A large part of the silver returned against lend-lease has not yet been credited on the books of the Treasury Department. In fact, in the case of India and Pakistan, shipment has not yet been completed but title has been passed by means of warehouse receipts. Returns of lend-lease silver are credited to U. S. Treasury free stocks, and it is from these stocks that silver is obtained for the minting of subsidiary coin and for sales to industry under the Act of July 31, 1946. Free stocks increased by about 40-million oz during 1957 due largely to lend-lease returns, which considerably exceeded requirements for subsidiary coinage of 51.4-million oz and sales to industry of 3.8-million oz.

Consumers, of course, have never been wholly dependent on new production for supplies. In recent years demonetized coinage provided a very important source of silver. For the past two years India has received substantial quantities of demonetized Tibetan coin. Until recently Saudi Arabian silver coin provided a very important source of silver for the market and they continued to appear through 1957, although in much smaller volume than in previous years. In addition, the Bank of England sold 7- to 8-million oz during 1957, which came from demonitized coin stocks.

Outlook. If there is no change in the silver policies of the U. S., it is probable that a pattern of price stability will continue. The current slowdown in business activity is generally expected to last into the months immediately ahead and its effects are being felt, not only in this country but abroad. Demand for silver is below the level of a year ago with no evidence of any nearby recovery of significance. Under these conditions the amount of domestic silver needed by the market will be limited.

As regards supplies, the recent cutbacks in production of copper and other non-ferrous metals is bound to have some effect on silver. This will not, however, result in an immediate reduction in refined output because the mines being closed down are probably those with the poorest grade ores and also there will be a time lag before the effect will be noticed in the output of silver bullion. In addition to new production, however, there are potential non-producer sources largely in the form of demonetized coin as was mentioned earlier. The extent to which these sources continue to come into the market will be important in determining whether or not current price levels will be maintained•

Magnesium

J. Donald Hanawalt
Dow Chemical Co.

PRODUCTION of primary magnesium totaled about 81,000 tons in 1957, a record for a peacetime year. An additional 6,000 tons of primary capacity will be available when Alabama Metallurgical Corp., a new company, builds its projected ferrosilicon-process plant at Selma, Ala., possibly in 1958.

In contrast to high production, primary magnesium consumption last year was about 47,000 tons, down 6,600 tons from 1956. This reflected the defense cutback and stretchout and the slight slowing of general business activity. The easing of demand for aluminum and the marked slackening of titanium production were the chief factors in the decreased magnesium sales. Magnesium is used as an alloying agent with aluminum and as a reducing agent with titanium.

About 40% of all primary magnesium consumed in 1956 was used structurally, a figure that may have increased somewhat in 1957. The increase would have been due to the substantially reduced sales to the aluminum and titanium industries while the consumption of magnesium fabricated forms declined a lesser amount.

The aircraft-missiles industry continued to be the chief consumer of structural magnesium, with machinery and tools in second place. Among nonstructural applications, alloying with aluminum, titanium reduction and cathodic protection were the main uses, in that order.

Outstanding market developments in 1957 were aircraft-missile industry recognition of magnesium-thorium elevated temperature alloys, availability of big magnesium extrusions and the Army's new emphasis on lightweight vehicles as exemplified in the all-magnesium "Mechanical Mule."

Magnesium-thorium alloys are used in the Bomarc, Talos and Vanguard missiles and are programmed for use in three IRBMs and one ICBM. Among aircraft using magnesium-thorium are the Convair B-58 "Hustler" and the Canadian Avro CF-105 "Arrow," two of the fastest in existence. The magnesium-thorium alloys maintain good mechanical properties in the critical middle-temperature range (450-750 deg F) and also offer light weight, good strength-weight ratio, high creep resistance and relatively low cost.

The magnesium industry's extrusion capacity was greatly increased when Dow Chemical Co. put its 13,200-ton press in operation at Madison, Ill. This press—the world's largest for extruding magnesium and one of the two largest for aluminum—can extrude sections up to 40 in. wide and up to 80 ft long. Portable magnesium landing-mat sections for the Army and massive aluminum wing sections for the B-52 program have already been produced on this equipment.

Magnesium castings, as well as wrought products, continued to be utilized extensively in aircraft. The Orenda Iroquois engines of the 1,500 mph-plus Avro "Arrow," for example, develop the best thrust-weight ratio in aviation history thanks, in part, to the weight saving achieved with scores of cast magnesium parts.

Demand increased for thin-walled magnesium castings in aircraft structural members, control surfaces and accessories. The largest one-piece thin-walled casting ever produced serves as the air scoop of the Navy's Regulus II missile.

In the commercial aviation realm, the Douglas DC-8 jet transport will use hundreds of magnesium castings to cut weight.

A record volume of magnesium forms went into military electronics equipment, where light weight is a crucial factor. From the standpoint of sheer size, probably the outstanding application is the Air Force's paraballoon radar antenna, which is supported by a light tripod fabricated from magnesium plate and extrusions. The entire assembly is 10 times lighter than conventional equipment.

The Army ordered volume produc-

tion of the air-transportable "Mechanical Mule" cargo carrier, essentially a platform of welded magnesium extrusions mounted on sand-cast magnesium wheels. This rugged cousin of the Jeep weighs 900 lb and can carry a 1,000-pound cargo, making it the first Army vehicle with a load capacity greater than its own weight.

Further use of magnesium in military ground vehicles may result from development of a magnesium-lithium alloy with promising armour characteristics. An armored personnel carrier fabricated from this material would weigh less than one-third as much as steel models now in service.

Nonmilitary uses of magnesium increased in some areas in 1957. Sales of magnesium tooling plate, a relatively new product, increased. Magnesium's light weight and machinability are fully utilized in this application and, in addition, the product now costs less on a pound-for-pound basis than its chief competition.

Magnesium photoengraving plate gained in acceptance. Most impressive development was the switch to magnesium by a large distilling company for all of its advertising after one of its major divisions had cut engraving costs 44% by converting to this metal.

Price disadvantages prevented the growth of magnesium die castings in the automotive field. However, development of an automatic metering process for cold-chamber die casting of magnesium shows promise of eliminating this gap.

A notable experimental development in 1957 was the Chevrolet Corvette Super Sport with an all-magnesium body and magnesium wheels. At the Indianapolis "500," all cars again were equipped with magnesium wheels, and three cars eliminated many pounds of dead weight by using magnesium body panels.

In the trucking field, a second manufacturer put on the market a delivery body built almost entirely of magnesium.

Good gains were recorded in certain chemical and metallurgical markets, such as the thermal reduction of beryllium, zirconium and uranium. Production of ductile iron was up slightly, resulting in a proportionate increase in the consumption of magnesium, which is used in the ductile iron process.

Use of magnesium anodes for cathodic protection increased slightly. With corrosion costs still enormous, magnesium's potential in this market remains vast, particularly with regard to underground pipe lines and marine hulls and ballast tanks.

Outlook. For 1958, tripled consumption of magnesium-thorium alloys is expected. Tooling plate sales are expected to rise, and the consumption of magnesium in alloying aluminum should be somewhat higher. These estimates are based on the rate of expenditure for military "hardware" that prevailed in the last quarter of 1957•

Lead

R. L. Ziegfeld
Lead Industries Association

CONTINUED WORLD OVERSUPPLY combined with a moderate decline in consumption, put enough pressure on the domestic lead market to break the price during 1957 from 16c per lb New York to 13c, despite continued substantial Government stockpile purchases. The lower price brought about some production curtailment late in the year. However, U.S. imports increased substantially and the domestic lead mining industry appealed for higher tariffs. The London Metal Exchange price fell below parity with New York even allowing for the maximum tariff increase which may be imposed. Restrictions placed on the barter program reduced the amount of foreign lead bought for stockpile under this program as the year progressed, but purchases of domestic lead for stockpile continued.

Stockpiling. The U. S. Government continued its policy of the last few years of buying domestically produced lead for the stockpile. Such purchases averaged about 7,000 tpm throughout 1957. Also, late in 1956 it made substantial exchanges of surplus agricultural commodities for foreign lead for the stockpile and this continued into the first few months of 1957. At that time stringent restrictions were placed on the barter program which all but put a stop to the acquisition of lead through barter and this method of removing surplus lead from the market.

It is estimated that some 150,000 tons were added to stockpile altogether in 1957, bringing the total in stockpile to substantially more than consumption in the U.S. in any past year, peace or war.

On the other hand the British government announced that it would dispose of 20,000 tons of lead from its stockpile. This naturally had a depressing effect on the market since the announcement came in October when the market was weak anyway. Originally it announced that it would dispose of 3,000 tpm starting with December but this was later changed to 1,200 tpm for the first six months of 1958, or 7,200 tons in the six-month period.

Price. With the support of stockpile purchases the New York price of lead remained remarkably stable at 16c per lb from Jan. 13, 1956 to May 9, 1957.

May 9	15.50
May 17	15.00
June 11	14.00
Oct. 14	13.50
Dec. 2	13.00

Production of lead from U.S. mines was lower than 1956 by about 5%, most of this curtailment taking place in the last quarter of the year. There can be little doubt but that curtailment was postponed, both here and abroad, by the Government stockpiling policies. Secondary production also was slightly lower by about 3- or 4%.

Imports of ore and concentrates were up moderately by about 5% but imports of metal increased substantially by about 16%. Total imports therefore were up about 11%, and accounted for nearly 40% of the total U.S. lead supply in 1957.

Thus total supplies of lead in the U. S. last year were slightly higher than in 1956. An increase during the year of some 25,000 tons in producer's stocks made the net available for consumption and stockpiling almost identical with the year before.

Consumption by industry showed a decline of about 6% to around 1,135,000 tons, of which about 5,000 tons was taken care of by a reduction of manufacturers' and secondary smelt-

Supply and Demand in the U.S.[1]

(Short tons)

	1957 estimated	1956
Supply:		
Mine production	335,000	352,826
Secondary production	490,000	506,800
Imports:		
Ore, matte, etc.	205,000	196,452
Pigs and bars	305,000	262,654
	1,335,000	1,318,732
Changes in stocks at primary smelters refiners	25,000[2]	8,437[2]
Total available	1,310,000	1,310,295
Demand:		
Industrial consumption	1,135,000	1,209,717
Consumers and secondary smelters stocks	5,000[2]	7,930[2]
	1,130,000	1,201,787
For stockpile and unaccounted for	180,000	108,508

[1]American Bureau of Metal Statistics, U. S. Bureau of Mines and Lead Industries Association. [2]Decrease. [3]Increase.

Monthly Average Lead Prices—N.Y.

(Cents per lb)

	1957	1956	1955
January	16.000	16.151	15.000
February	16.000	16.000	15.000
March	16.000	16.000	15.000
April	16.000	16.000	15.000
May	15.385	16.000	15.000
June	14.320	16.000	15.000
July	14.000	16.000	15.000
August	14.000	16.000	15.000
September	14.000	16.000	15.100
October	13.692	16.000	15.500
November	13.500	16.000	15.500
December	13.000	16.000	15.558

Lead Use In the U.S.*

(Short tons)

	1957 estimated	1956
White Lead	17,000	16,951
Red lead and litharge	76,000	79,199
Storage batteries	375,000	370,771
Cable	115,000	134,339
Building	51,000	58,277
Tetraethyl lead	173,000	191,990
Ammunition	42,000	44,438
Foil	5,000	4,593
Bearing metal	26,000	28,321
Solder	72,000	75,290
Type metal	25,000	26,709
Calking lead	65,000	64,970
Other uses	93,000	113,869
	1,135,000	1,209,717

*Based on U. S. Bureau of Mine statistics.

ers' stocks. With supplies at 1,310,000 tons, this left about 180,000 tons for stockpiling and unaccounted for.

Tariffs. For several years the Administration in Washington had been working on a long-term minerals program which was presented to Congress in 1957. Among the recommendations presented was one for a sliding scale tariff or excise tax on lead, the tax to increase by steps as the price declined and to be eliminated entirely when the price was above a certain level. Bills to that effect were introduced in both houses of Congress, but after Committee hearings, no action was taken. Administration was informed by Congress that it already had the power to increase tariffs through the escape clause provisions of the Reciprocal Trade Agreements Act.

As a result the domestic lead and zinc mining industry, through the Emergency Lead-Zinc Committee, appealed to the Tariff Commission for relief. Hearings were held in November and various witnesses asked for greater tariff protection, import quotas or both, while others, particularly foreign producers, opposed any changes. As the year closed the report of the Tariff Commission to the President was awaited.

Under the escape clause provisions, the tariff on lead ores and concentrates could be increased from ¾c per lb of lead content to a maximum of 1.8c per lb, and on lead metal from 1 1/16c per lb to a maximum of 2.55c. Meanwhile the lead price on the London Metal Exchange discounted the possible tariff increases and fell well below parity with the domestic market, even allowing for the maximum possible tariff increase. It recovered somewhat from its low before the year end.

Uses. Of the three major uses of lead, only storage batteries gave a reasonably good account, and even these were somewhat disappointing in that consumption in batteries increased no more than about 1%. Apparently technological advances which permit the manufacture of batteries with longer lives but with less lead per battery are having their effect.

On the other hand, tetraethyl lead used 10% less lead than in 1956 which was its peak year. The drop of about 19,000 tons to 173,000 tons in 1957 is probably attributable to two factors: a decline in total gasoline consumption, and the coming on-stream of a number of new catalytic cracking plants, started a couple of years ago, which provided a greater pool of high quality stock requiring less TEL per gallon.

The third major use, cable sheathing, showed even a larger percentage decline of nearly 15%, dropping to about 115,000 tons. The 1957 usage was disappointing and probably reflects catching up on the back-log of power and telephone cable requirements, a shortage of which has persisted since the war.

Because of the decline in home building, it is natural to expect that the use of lead for this purpose would be adversely affected. The figure for building, which includes chemical construction as well, was down to 51,000 tons, a decline of 12%. However, caulking lead held steady at around 65,000 tons.

All the other uses of lead either held their own or showed only moderate declines, with the exception of miscellaneous or unclassified uses. The latter was down about 18%, to 93,000 tons.

In general, the lead consumption picture as presented in 1957 would not be too disturbing were it not for the continued overproduction throughout the world. No new major threat to established uses of lead presented itself. Consumption either followed the general business trend or special conditions, in some instances, which are not likely to be permanent.

Outlook. For the immediate future, that is the year 1958, there appear to be no special features which would lead us to believe that consumption will do anything but follow the pattern of business in general. Most manufacturers' inventories are comparatively low and any improvement in their business would have to be reflected rather quickly in increased buying. It may be expected that the sustained advance in the use of lead for tetraethyl lead, which started in 1923 and which felt no appreciable setback until 1957, will again be resumed in the future. However, because of the conditions which caused this setback, improvement is not likely to be felt for another 6 to 12 months.

Furthermore, it is also unlikely that the technological improvements in batteries, which have kept pace with the growth in automobile registrations in the last few years, can continue at that rate. In other words, barring the development of an entirely new type of battery for automotive use, which is not indicated, it seems highly improbable that the amount of lead per battery can continue to be reduced indefinitely while the life of the battery is increased indefinitely.

A moderate up-turn in home build-

ing, which is already indicated, would be beneficial to lead but would be balanced by any curtailment of industrial investment in new plants. The hugh Federally-aided road building program should be reflected in substantially increased demand for red lead paints for steel highway structures, since state highway specifications preponderantly favor this type of paint. New developments in the ceramic industries, such as porcelain enamelled aluminum, low firing porcelain enamels for steel, the use of lead in electronic and other ceramic bodies and other applications, all point to steadily increased use of lead in ceramics, but they cannot be expected to develop rapidly.

On the other hand, lead production should be substantially lower in 1958 due to the depressed price. Recent figures indicate that domestic mine production will be some 4,000 or 5,000 tons a month lower than in the first half of 1957. Foreign production will probably also be at a lower rate.

There are a number of other factors that will affect the 1958 lead market. For example, how long and at what rate will the Government buy lead for stockpile? What will the Tariff Commission recommendations be and will they be accepted by the president?

For the longer future there are definitely a number of optimistic signs, not the least of which is the determination of the industry to make a virtue of its capacity to produce at a higher rate. This not only is an incentive to find new uses or expand present uses but is an assurance that there will be enough lead to take care of them. A few years ago lead consumers were frightened by shortages and tried to find substitutes for lead. Now they can be encouraged to use lead freely in ways they have never used before.

With this outlook the lead industry is embarking on the largest and most intensive research and market development program in its history. The possibilities in ceramics and highway construction have been mentioned. It is also engaged in a study of the development of new products for the building construction field. A complete survey of research possibilities in every area has just been completed by the industry.

That lead is adaptable to modern technology is found in a number of new developments, none of which are necessarily important tonnage-wise but which indicate that any day a new large use or many smaller ones may become commercially important. For instance, the Navy developed a tiny lead-silver rechargeable dry-cell battery for use in electronic equipment. Infrared sensitive lead sulphide is used in the guiding mechanism of the Army's Nike missile. Lead compounds can be used as modifiers in rocket fuels. Lead is almost essential as shielding against gamma rays in mobile nuclear units. Lead stabilizers are important in vinyl plastics. Powdered lead in combination with polyethylene, paraffin and other binders is finding new commercial applications. White lead has been found to almost double the emissivity of copper•

Zinc

Charles R. Ince
St. Joseph Lead Co.

THE STABILITY IN PRICE which the market had enjoyed for 15 months was abruptly terminated in May of last year following the cessation of the Government's bartering of agricultural surplus for strategic materials, of which zinc was one. Without this "prop" to absorb surpluses and facing a declining trend in consumption, the market immediately reacted to the law of supply and demand and very quickly adjusted to the 10c level which prevailed at the end of the year. The drop in price was probably the sharpest in the experience of the industry — the decline of 26% from the 13.5c level taking place in a period of less than eight weeks.

The resultant oversupply of zinc concentrates and metal brought about an intensely competitive market in the last six months of the year. In line with the downturn in industrial activity, zinc consumption dropped 7% from the previous year's rate to an estimated 935,000 tons. While the use of the metal fell, total supply, which had already been in excess of domestic requirements in the previous year, increased about 3.6%. Substantial surpluses existed in both years (see Balance Sheet).

While U. S. smelter production decreased slightly in 1957, net metal imports jumped 22% by an estimated 55,000 to around 300,000 tons. Curtailment of mine and smelter production was initiated by domestic producers during the third and fourth quarters of the year. Mine production at the end of the year was running 15% below the rate prevailing the earlier part of 1957.

U. S. Agricultural Department's barter program, trading domestic agricultural surpluses for zinc produced from foreign origin concentrates, helped to remove excesses from the market in 1956 and during the first four months of 1957. The sudden cutoff of this program in the last Spring put substantial tonnages of metal on the market which had been destined for delivery to the U. S. Government for the supplemental stockpile.

With supply far in excess of demand, users were satisfied that there would be no shortage of metal throughout the entire year and started to liquidate 60 to 90-day inventories. While most of this liquidation was completed during the first three quarters of the year, consumers are still hesitating to buy for inventory, preferring to purchase on a hand-to-mouth basis. Statistically, this is borne out by the fact that consumers' stocks dropped about 30,000 tons during the year while refiners' stocks rose some 98,000 tons.

Price adjustments were inevitable. On May 6, 1957 the price fell from 13.5c per lb to 12c. It had been at the 13.5c per lb level since Jan. 7, 1956. By July 1 the price had fallen 26% to 10c per pound. East St. Louis quotation of 10c per lb prevailed throughout the remainder of 1957.

Zinc's largest consumers—the steel and automotive industries — gave mixed performances during the year. Zinc consumption by galvanizers fell almost 15% as most continuous galvanized sheet lines failed to work to capacity. There are now 34 lines in operating condition with an estimated capacity of 2,894,000 tons (this figure is based on 100%, but steel men point out that the lines could work in excess of 100% if necessary). Most job galvanizers experienced a year which compared favorably with 1956. Captive hot dip galvanizing operations were more seriously curtailed as the end products of the parent companies (largely in the electrical utility field)

Zinc Balance Sheet

(Short tons)

	1957 estimated	1956	Percent change
Consumption	935,000	1,009,000	− 7.0
Supply			
Smelter production	1,057,000	1,063,000	− 0.6
Metal imports	300,000	245,000	+22.4
	1,357,000	1,308,000	
Less exports	11,000	9,000	+22.2
Total	1,346,000	1,299,000	+ 3.6
Surplus	411,000	290,000	
Distribution of surplus:			
Refiners' stocks changed	+ 98,000	+ 28,000	
Consumers' stocks changed	− 30,000	− 19,000	
Shipments for govt. account (domestic)	180,000	157,000	
Stocks in warehouses Import for government stockpile Metal in transit	163,000	124,000	
Consumption by industries			
Galvanizing	363,000	439,000	−15.0
Die casting	375,000	360,000	+ 4.2
Brass mills	110,000	124,000	−11.3
Rolled zinc	41,000	47,000	−12.8
Oxide	21,000	19,000	+10.5
Other	25,000	20,000	+25.0
Total	935,000	1,009,000	− 7.0

experienced a lack of demand in the last half of 1957.

A survey conducted by the American Iron and Steel Institute on the uses of sheet reveals several growing applications. The mushrooming air conditioning market is calling for large tonnages of the product for ducts, vents, etc. During 1948 only 22,600 tons were used for this purpose while some 127,700 tons were consumed by the air conditioning industry in 1956. With most older office buildings being renovated for central air conditioning and all new office and industrial buildings having some type of central air cooling, the trend toward greater use of galvanized sheet should be greatly accentuated during the next decade. Galvanized sheet shipments for the production of road culverts were 161,000 tons in 1948. In 1956, 330,500 tons were consumed. The U. S. Road Building Program virtually guarantees a successful period for culvert makers. Agricultural uses for galvanized sheet have almost doubled since 1948, rising from 91,100 tons to 180,100 tons luring 1956. Zinc producers are currently helping to promote the use of all types of galvanized products to the American farmer through a special project of the American Zinc Institute. Total shipments of galvanized sheet have risen from 1,643,000 tons in 1948 to 2,958,000 tons in 1956. During 1957 about 2.4-million tons were shipped.

For the first time in the history of the zinc industry the tonnage used for die casting exceeded the amount consumed by the galvanizing industry. While this was caused in part by the sharp decline in shipments to the steel industry, it is significant to note that the use of zinc for die casting not only held at the 1956 levels but showed a slight gain of about 4.2%. While major uses such as galvanizing, zinc for the brass mill industry and rolled zinc failed to live up to expectations, zinc for die casting had its second best year (375,000 tons). During 1956, 360,000 tons were used by the die casting field. Last year's results were topped only by the record year of 1955 when 410,000 tons were used by the die casting industry.

The average amount of zinc die castings used by each automobile produced during the past three years breaks down as follows: 1955, 68.7 lb; 1956, 71.3 lb; 1957, 77.0 lb. While it is still too early in the model year to give a verified estimate on the amount of zinc die castings going into 1958 automobiles, the average should be at least 80 lb per car. A trend appears to be developing toward the use of heavier zinc die cast instrument housings, larger tail light sections and head light assemblies. Another area showing an increase is in the use of zinc die castings for window supports on the popular hard top models.

While these results are encouraging, the zinc industry is taking steps to see that these gains are held and expanded. It is anticipated that joint research projects now being conducted will further enhance the value of using zinc die castings in the automotive and appliance fields. The current ratio between the use of zinc and aluminum die castings on a weight basis stands at about 65% for zinc and 35% for aluminum. This is about the same proportion which has prevailed between the two metals for the last four years during which the differences in zinc and aluminum die cast alloy prices have fluctuated widely. This would tend to show that neither zinc nor aluminum are expanding at the expense of the other in the die casting industry and that the relative price of the two metals is not a major factor in their choice—rather it appears to be the availability of the metal and the properties required in the particular application.

Brass mills, the third most important outlet for zinc, had disappointing sales volume throughout most of 1957. Result: Sales of zinc to the brass mill industry were off more than 11%. The copper, brass and bronze makers, who had experienced severe shortage of the red metal in 1955 and part of 1956, saw tranquil labor conditions throughout the world allow copper production to catch up and then pass demand. In addition, rapidly falling copper prices increased customer resistance to "buy for inventory" and this, coupled with the generally lower demand for brass mill products, dropped the use of zinc from 124,000 tons in 1956 to about 110,000 tons in 1957. The tonnage of zinc converted into zinc oxide rose 2,000 tons from 1956 results to a total of 21,000 tons. Miscellaneous uses did not follow the downtrend, but showed a gain of some 5,000 tons from the 20,000 tons recorded in 1956.

With the U. S. population gaining another 2-million people during the past year (168-million vs 170-million) and zinc consumption off 7%, per capita consumption dropped to 10.9 lb from the 1956 total of 11.9 lb. The 10-year average per capita consumption figure is 11.54 lb. It is interesting that the per capita use just prior to World War II was identical with 1957 but there were 38-million fewer people. It would appear that there is plenty of room for development of "growth" applications in the zinc industry.

At the end of 1957 the fortunes of the U. S. zinc industry appeared

(Continued on p. 167)

Minor Metals

Marshall Sittig
President and General Manager
American Lithium Institute

"Tomorrow's end-use will put heavy emphasis on metal, perhaps making it No. 1 product in years to come."

Peter Colefax
President
American Potash & Chemical Corp.

"Two boron fuel plants set for 1958-1959 will not significantly affect borate use in 1958."

William R. Barton
Commodity Specialist
U.S. Bureau of Mines

" . . . in the not too distant future, price of 99.5% pure columbium and tantalum will reach . . . $10 a lb."

James W. Pennington
Assistant Chief, Base Metals
U.S. Bureau of Mines

"Mercury output in 1958 will probably continue at 1957 level; at GSA-guaranteed $225 a flask."

◄**Wilmer McInnis**
Commodity Specialist
U.S. Bureau of Mines

Frank L. Fisher►
Commodity Specialist
U.S. Bureau of Mines

"Germanium, selenium and high-purity silicon dominated the rapidly expanding semi-conductor field in 1957. Germanium's outlook is excellent. Substitutes made significant inroads into selenium rectifier industry."

Donald E. Eilertsen
Commodity Specialist
U.S. Bureau of Mines

"U.S. Bureau of Mines research on beryl flotation and beryllium extraction is promising."

James Paone
Commodity Specialist
U.S. Bureau of Mines

"Enthusiasm for earth satellites and space travel will undoubtedly . . . affect thorium consumption."

Frank W. Wessel
Commodity Specialist
U.S. Bureau of Mines

"Zirconium's corrosion resistance is important in its future demand picture—so is hafnium's."

Arnold M. Lansche
Commodity Specialist
U.S. Bureau of Mines

"1958 cadmium output depends on zinc mining [U.S.] and on imports of zinc concentrates."

J. Patrick Ryan
Commodity Specialist
U.S. Bureau of Mines

"Free World . . . supply of platinum . . . improved by development of new reserves and output expansions."

Howard E. Kremers
Secretary
Lindsay Chemical Co.

"Domestic rare earth supplies are adequate. . . . Long range use research is under way at Battelle."

MINOR METALS

Semi-Conductors

Frank L. Fisher & Wilmer McInnis
U.S. Bureau of Mines

GERMANIUM, selenium and high purity silicon dominated the rapidly expanding semi-conductor industry in 1957 as demand for these materials for transistors, diodes, rectifiers and other electronic devices reached new peaks. The supply of all three materials was more than ample to meet the unprecedented requirements and each material attempted to attract new consumers with price reductions during the year. It is expected that germanium, silicon and selenium will more than keep pace with the anticipated demands for semi-conductors in 1958 and, where their operating qualifications overlap, competition among the three will be strong with selenium probably losing ground to the other two materials.

The unpredictable future for these three semi-conductors becomes more enigmatic as more rigid specifications, new technology and complexity of design are introduced which approach their upper performance limits. An estimated 600-million semi-conductors will be required by 1965 and this attractive potential market has stimulated a search for substitutes which will perform satisfactorily in the anticipated new ranges of operation. Production of selenium, germanium and silicon semi-conductors is estimated at more than 70-million units in 1957, an increase of some 50% over 1956.

Selenium in 1957 was highlighted by a peak domestic production, a sharp decline in volume of imports, a severe drop in consumption, and a build-up of producer stocks that reached an all-time high. Consumers, conscious of an unstable market situation, apparently reduced inventories during the year as two major price decreases failed to ease buyer resistance. The future status of the selenium industry at the end of 1957 was clouded with uncertainty.

Selenium production in 1957 totalled an estimated 1.1-million lb. This compares to a record 1,117,000 lb in 1956. The secondary industry, which was active at the beginning of the year slackened toward the close in the face of price reductions. Major sources of selenium scrap were factory scrap from the manufacture of rectifiers, burned out rectifiers and spent catalysts. The five companies which produced approximately all of the 1957 primary and secondary production were: American Metal Co., Ltd., Carteret, N.J.; American Smelting & Refining Co., Baltimore, Md.; International Smelting & Refining Co., Perth Amboy, N.J.; Kawecki Chemical Co., Boyertown, Pa.; and the Kennecott Copper Corp., Garfield, Utah.

Shipments to consumers dropped from an average of 86,000 lb a month in 1956, to an estimated average of 50,500 lb a month in 1957. At the same time, producer stocks increased sharply from 191,000 lb Jan. 1, 1957, to a record 588,000 lb Oct. 1, 1957. Imports decreased during the same period from an average of 19,500 lb a month in 1956, to an estimated average of 11,500 lb in 1957. Canada was the major source of the imports with sporadic shipments received during the year from Japan, West Germany and Sweden. Exports of selenium and its compounds were restricted at the beginning of the year by a quota of 6,000 lb per quarter. During the first quarter of the year the quota was increased to 10,000 lb and again for the second quarter to 20,000 lb. During the last half of the year selenium and its compounds were on an open-end basis. Export licenses were still required by the Department of Commerce.

Selenium remained in Group I of the Strategic and Critical Materials list throughout the year. DMEA made selenium eligible during 1957 for financial assistance in exploration projects, with Government participation set at 75% of the authorized cost of the project. Only limited research for selenium from alternate sources of supply were conducted during the year and very little interest in selenium exploration and development was in evidence.

The major outlet for selenium continued to be for rectifiers and other electronic equipment in 1957. Substitutes made significant inroads into the selenium rectifier industry and the technical advantages and advances made by silicon and germanium indicate that further cutbacks in the use of selenium in the electronic industry will occur in 1958. Selenium use in the chemical, glass, ceramic, pigment and metallurgical industries was normal in 1957 and should continue as such during 1958. The numerous amphoteric phases of selenium and its many useful physical and chemical properties point with favor toward many new uses in the future under a competitive price and stable supply.

On Jan. 1, 1957, commercial-grade selenium was quoted at $12.00 a lb and high-purity selenium at $15.00 a lb. Price of commercial grade was changed to $10.50 a lb and high purity to $13.50 a lb on May 28, 1957. On Nov. 18, 1957, the price of commercial grade was reduced to $7.50 a lb and high purity to $10.50. Ferroselenium was reduced from $11.25 to $8.00 a lb at the same time.

Germanium made important advances in the electronic field in 1957 as new designs in germanium semiconductor devices permitting a wider range of applications were introduced. Although the number of transistors manufactured during the year increased sharply, the supply of metal from domestic and foreign sources was ample to meet increased industry demand. Improved processing techniques and design allowed significantly more transistors, diodes, and rectifiers to be made from a pound of germanium than previously. Significant strides were made during the year in the use of germanium in miniaturization and micro-miniaturization of semi-conductor devices. Germanium statistics are not available for 1957.

The major domestic source of germanium continued to be as a by-product of zinc production from the Tri-State district with much lesser production from the Illinois-Kentucky fluorspar district. Domestic producers in 1957 were, American Zinc Co. of Illinois, Fairmont City, Ill.; Eagle Picher Co., Miami, Okla.; and Sylvania Electric Products, Inc., Towanda, Pa. A large increase in foreign production became a reality in 1957 when the Oolen plant of the Societe General Metallurgique de Hoboken began full operation at Hoboken, Belgium. This plant processes flue dust from Union Miniere du Haut Katanga copper-zinc smelting operations in the Belgian Congo and germanium concentrate from Tsumeb Corp., Ltd., South West Africa.

The outlook for the germanium industry is excellent for 1958. A wider range of applications and promising new developments indicate that under normal conditions production and consumption should continue to increase sharply. The use of germanium rectifiers for high-amperage installations has met with remarkable success and should maintain steady growth.

Germanium Prices—1957

(Cents per gram)

	First reduction		Intrinsic quality		
	1000 gm lots	10,000 gm lots	1000 gm lots	10,000 gm lots	
Jan. 3	48½	44½	53½	48½	f.o.b., Miami, Okla.
May 16	43½	39½	48½	43½	f.o.b., Miami, Okla.
June 6	40	38	44½	45½	delivered
June 6	43½	42½	48½	42½	f.o.b., shipping

Ultra-Pure Silicon Prices

(Dollars per lb)

Semi-conductor grade	Maximum boron content	Minimum resistivity for top 60% of crystal "P" type	"N" type	Price
I	3 ppb	100 ohm cm	25 ohm cm	$360.00
II	6 ppb	50 ohm cm	15 ohm cm	250.00
III	11 ppb	25 ohm cm	5 ohm cm	160.00
Solar cell grade		Minimum resistivity measured at 60% point "N" Type 0.5 ohm cm		$100.00

Timepieces and other small household appliances and toys employing transistors were introduced during the year. Announcement in November of the successful use of germanium as a component of printed circuits is a major advance in miniaturization in the use of transistors and diodes—but one which will require considerably less germanium per unit.

Price of the metal was reduced in May and again in June 1957. It remained unchanged from June 6 through the end of the year. The price of germanium dioxide was quoted at 17½c a gram throughout 1957. The metal price basing system changed during the year. Price changes are shown in the accompanying table.

Ultra-pure silicon is fast becoming one of the preferred materials in solid-state semi-conductor devices. It was the subject of much research and speculation in 1957 when many research laboratories were busily engaged in perfecting production techniques to improve its purity while others were investigating its properties in various applications. Some firms claimed to have developed production processes that would yield a product containing impurities totalling only about two parts per billion.

DuPont was by far the largest producer of high-purity silicon in 1957, but Sylvania Electric Products, Inc., Westinghouse Electric Corp., Texas Instrument Co., Eagle Picher Co., and Kawecki Chemical Co. also were reported to have produced the material during the year. Actual production data are not available but domestic output during the year was estimated at about 30,000 lb compared with 15,000 lb in 1956.

W. R. Grace & Co. announced plans for the construction of a plant for producing 20,000 lb of ultra-pure silicon annually and Merck & Co. announced that it would start production of the material early in 1958. DuPont had under construction a new plant, near Brevard, N. C., with an initial annual capacity of 70,000 lb silicon to be operating in 1958.

Consumption of ultra-pure silicon in 1957 was estimated at about 25,000 lb. Some commercial applications of transistors, diodes and rectifiers were in the manufacture of radios, televisions, guided missiles, variable speed motors, telephone systems, welding equipment and infrared lenses. Solar-cell grade silicon was used in solar batteries for radios, telephone line power source and toys.

Prices quoted for ultra-pure silicon varied according to purity and resistivity. DuPont quoted the accompanying prices for its material effective Nov. 7, 1957, f.o.b. common carrier, Newport, Del.

Outlook for ultra-pure silicon in 1958 appears that both production and consumption might be on the order of 40,000 to 50,000 lb•

Bismuth

Abbott Renick
U.S. Bureau of Mines

DOMESTIC REFINERY PRODUCTION in 1957 increased about 10% above that of 1956. Based on data for the first nine months, total imports of refined bismuth for 1957 were estimated at about 920,000 lb, compared with 918,000 in 1956. Approximate percentage distribution of receipts by countries of origin was: Peru 63%, Mexico 28%, Yugoslavia 5% and others 4%. Exports of bismuth metal and alloys totalled 198,000 lb, a 31% decrease from the 1956 figure for exports.

Data on the first nine months of 1957 indicated that the demand for metal was expected to increase about 6% above 1956 and total about 1,600,000 lb. Consumption of bismuth in fabricating alloys was about 1,125,000 lb (70%), 3% above that in 1956. Consumption in pharmaceuticals and industrial chemicals was about 475,000 lb, an increase of about 12%.

Bismuth Statistics

(Thousands of lb)

	1957 estimated	1956
Consumption	1,600	1,513
Imports	920	918
Exports	198	287
Average price N. Y., per lb, ton lots	$2.25	$2.25

The New York market price of high quality metallic bismuth remained throughout the year at $2.25 per lb in ton lots, unchanged since Sept. 5, 1950.

Outlook. Several new uses for alloys are being investigated which may have a marked influence in increasing world requirements. Nevertheless, it is difficult to forecast, with any assurance, the supply-demand picture over an extended period. The most logical assumptions are that demand will increase but that supply will be adequate during the ensuing decade•

MINOR METALS

Columbium-Tantalum

William R. Barton
U.S. Bureau of Mines

THE EFFECT of halted U.S. Government purchases on the production of foreign columbium-tantalum ores was reflected clearly in U.S. imports. During the first nine months of 1957, imports were 2,502,472 lb of columbium concentrate and 451,880 lb tantalum concentrate, compared with 4,253,261 lb and 744,500 lb, respectively, during the same period in 1956.

Porter Brothers Corp. euxenite-columbite placer mine at Bear Valley, Idaho, increased its production of concentrate and continued to produce the great bulk of domestic columbium-tantalum concentrate. Production of columbite-tantalite from U.S. pegmatites continued to be insignificant. The search for additional domestic ore supplies received a deterrent in October 1957, when Government participation in columbium and tantalum mineral exploration was reduced from 75% to 50% by DMEA.

Industrial demand continued strong for tantalum, columbium-tantalum-bearing ferroalloys, columbium-containing nonferrous alloys and for cemented carbides. During the year, Wah Chang Corp. and Electro Metallurgical Co. began commercial production of pure tantalum and columbium metal, and the new Muskogee, Okla. plant of Fansteel Metallurgical Corp. was placed in operation. Capacities of other firms also were expanded.

Prices of columbium at the start of 1957 ranged from $75 to $160 per lb for various grades. In May, however, Shieldalloy Corp. announced the availability of 97%-plus columbium from H. C. Starck, Goslar, Germany, at $16 per lb, in quantities, f.o.b. New Jersey. During October, Electro Metallurgical Co. announced a price schedule for 99.5% purity metal ranging from $55 to $85 per lb. Higher purity metal ingot was reported obtainable late in the year in the price range of $85 to $125 per lb.

Tantalum metal was nominally quoted per kilogram during the entire year, at $128 for rod and $100 for sheet. The price for columbite concentrate per pound of contained pentoxide (65% combined pentoxides minimum), with a Cb/Ta ratio of 10:1, was $1.25-$1.35 at the start of the year. On Jan. 10, the price became $1.35-$1.40 until Oct. 3, when the quotation dropped to $1.15-$1.20 for the remainder of the year. Concentrate with a Cb/Ta ratio of 8½:1 underwent concomitant price adjustments from $1.05-$1.15, to $1.15-$1.20, and finally $1.00-$1.05.

Outlook for increased future consumption of both metals is excellent. It is possible that in five years domestic industrial consumption of columbium-tantalum, as measured by the combined metal content in the ore used, may be several times the 810 tons of combined metal content utilized in 1956.

Cutbacks in defense requirements late in the year, combined with expansion of facilities, eased slightly the tight tantalum supply situation. Industrial demand continued to increase with the likelihood that consumption of tantalum will grow rapidly. Increasing quantities of columbium will be used in ferroalloys and special nonferrous alloys. Greater missile production, or the advent of automotive gas turbines, probably would expand greatly the demand for certain columbium-bearing high-temperature alloys. Nuclear reactor use of columbium cannot be clearly forecasted. Columbium is used as a fuel alloying element and as fuel cladding in fast reactors, and the excellent strength-to-weight ratio of columbium alloys make them attractive as a structural material in aircraft reactors.

New production techniques and larger-scale production facilities promise that in the not too distant future the price of 99.5% purity columbium and tantalum metal powders may reach the level of $10 per lb•

Mercury

James W. Pennington
U.S. Bureau of Mines

THE HIGHEST U.S. peacetime rate of mercury production in over 50 years was attained in 1957 as mine output rose 30% over 1956. Significant gains in California, Alaska and Oregon raised domestic mine output to an estimated 31,500 flasks despite declines in Idaho and Nevada. Over 95% of the mercury was supplied by 20 mines that produced 100 flasks or more with the remainder derived from about 100 smaller operations.

California not only continued to lead all states in mercury production, but also increased its share of the U.S. total by supplying 45%, compared with 37% in 1956; Nevada accounted for 17%—a drop from 24%; Alaska and Oregon supplied 17% and 12%, respectively,—up from 14% and 8%; Idaho's contribution dropped to 7% from 14% (the Cinnabar mine was inactive during the year); and Arizona, Texas and Washington furnished the rest.

Mercury Statistics

(76-lb flasks)

	1957 estimated	1956
Production (mine)	**31,500**	24,177
Imports (general)	**45,000**	52,009
Consumption	**54,000**	54,143
Average price, New York	**$247.00**	$259.92

Secondary production of mercury continued at the 1956 level. From January through September reclaimed metal totalled 4,360 flasks, compared with 4,270 flasks in the corresponding period of the preceding year. Annual production of secondary mercury probably reached 6,000 flasks or 16% of the combined primary and secondary output.

General imports of mercury rose in the first quarter of the year but declined in each of the succeeding two quarters. During the first nine months 39,000 flasks were imported, compared with 40,000 flasks in the corresponding period of 1956. Total 1957 imports probably dropped 7,000 flasks from the 52,000 flasks of 1956. Spain continued as largest supplier and increased its output to 60% of

total from 35% in 1956; Italy's share dropped from 34% to 21%, nearly all received in the first quarter; Mexico accounted for only 10%, compared with 24%; United Kingdom, Yugoslavia, Peru, Canada and Colombia supplied the remainder in decreasing order.

Exports and re-exports, though usually small, increased upon the removal of export restrictions in the last quarter of 1955 and continued relatively high through 1957. In the first nine months of 1957, exports totalled 1,800 flasks, compared with 300 flasks in the similar period of 1956. Re-exports in the first three quarters of 1957 totalled 3,200 flasks —more than double the similar quarter of 1956.

Industrial consumption continued at a high level during the year and probably equaled the 54,000 flasks used in 1956. Expansions at four chlorine and caustic soda plants using mercury cells were largely responsible for the high consumption. In other large uses such as agriculture (including insecticides, fungicides and bactericides for industrial purposes) and industrial and control instruments, consumption declined; but a gain was registered in make-up metal for the manufacture of chlorine and caustic soda. Only slight changes were noted in other uses.

Industrial stocks dropped from 22,000 flasks at the beginning of January to 19,000 flasks at the end of September. However, during this period consumers' and dealers' inventories fell 6,000 flasks whereas producers' rose 3,000 flasks. Producers' year-end stocks were undoubtedly reduced; when the price fell to near the Government purchase program. level in the fourth quarter, mercury was tendered to and accepted by the Government. In addition, because of the timing problem encountered by participants in securing specified flasks, on Nov. 22, ODM extended the delivery date of mercury tendered before Dec. 31, 1957 to March 31, 1958. Such mercury would be applied to quantities authorized for acceptance under the quota expiring Dec. 31.

Prices of $255 to $257 a flask, established in July 1956, continued until the latter part of July 1957. Thereafter, prices declined without interruption to a range of $225 to $230 a flask in November and remained unchanged the rest of the year. Average price for the year was expected to be about $13 lower than 1956's $259.92 a flask.

The two Government-sponsored programs—DMEA's exploration assistance and the guaranteed purchase sale price—continued through 1957. The former, which provided loans up to 75% of the exploration costs for eligible mercury deposits, was revised on Oct. 18 to lower Government participation to 50%. The purchase program administered by GSA provided for the purchase, at $225 a flask, of a maximum of 125,000 flasks of domestic mercury and 75,000 flasks of Mexican metal, was scheduled to end Dec. 31, 1957. However, on March 21, ODM authorized GSA to extend the mercury purchase-program through 1958, and permit the acquisition of up to 50,000 flasks: 30,000 flasks from domestic and 20,000 flasks from Mexico, at a guaranteed price of $225 a flask.

GSA issued a revision of the mercury regulations Nov. 8 extending the program and clarifying the section on packaging. In another Government action April 25, ODM closed expansion goal No. 64 for mercury, which had been established Apr. 1, 1952, following studies that indicated sufficient capacity either is planned or now exists to meet presently known mobilization requirements.

With the extension through 1958 of the Government purchase program for mercury, domestic production and price should remain fairly stable. Output will probably continue at the 1957 level and the price should approximate the GSA guaranteed price of $225 a flask. Expanding demands in some of the new or larger uses of mercury should maintain mercury consumption at a relatively high level in 1958•

Cadmium

Arnold M. Lansche
U.S. Bureau of Mines

SUPPLY IN 1957 was about 9% above demand for the metal. Total new supply, consisting of metal production at domestic plants and general imports, was nearly 11.9-million lb, 4% below that of 1956. Demand, as measured by apparent consumption, was approximately 10.9-million lb, 14% less than in 1956. Production of primary and secondary cadmium metal together was about 10.4-million lb, only 2% below 1956 in spite of the shutdown of several zinc mines and somewhat depressed business conditions during 1957. Domestic output of cadmium was derived from zinc ores and ores containing zinc from domestic and foreign mines, and cadmium-bearing flue dust obtained from smelters in Mexico. Metal producers' shipments of cadmium, including that for internal consumption, declined about 11% to 9.8-million lb in 1957. At the end of the year producers' stocks of the metal stood at 3.1-million lb, 9% above Dec. 31, 1956. Compound producers' year-end metal stocks were down to about 92,000 lb, 29% below 1956. Distributors' metal stocks at the end of 1957 were at 266,000 lb, up 4%.

General imports of cadmium metal were estimated to be 1.52-million lb for the year compared with 1.75-million lb in 1956, a decline of 13%. General imports of flue dust, cadmium content, were about 1.74-million lb (1.62-million lb—1956) up 7%.

Metal exports, including alloys, dross, flue dust, residues and scrap were approximately 740,000 lb, 42% below those of 1956. United Kingdom received more than three-fourths of the exports, with the remainder going to Canada, Mexico, Bolivia, Chile, Brazil, Netherlands, Belgium-Luxembourg, Switzerland, Italy, India and the Philippines.

Price of cadmium sticks and bars, and platers' shapes delivered in 1- to 5-ton lots, remained unchanged at $1.70 per lb in spite of the decline in price of some competitive metals such as tin and zinc.

Electroplating, pigment manufacture, and production of silver-brazing and other low-melting-point alloys continued to be the chief uses of cadmium.

There were no new barter contracts let by the Government in 1957 for the purchase of cadmium for the strategic and supplementary stockpiles.

Outlook for cadmium in 1958 from the standpoint of production will de-

pend on the level of zinc mining in the U. S. and imports of zinc concentrate and cadmium-bearing flue dust. Demand for cadmium will probably remain at about the 1957 level.

Science developed several interesting new aspects of cadmium which appear to improve its prospects. A new type 1.2v nickel-cadmium battery was introduced. It is a sintered plate battery, about the size of a fifty-cent piece, developed for use in miniature electronic applications. Its principal features are rechargeability, hermetic-sealing, non-gassing upon recharging and low internal resistance which permits high discharge. A method of vacuum deposition of cadmium on steel parts has been developed which eliminates hydrogen embrittlement. The throwing power of this process is said to be superior to that of conventional plating methods. The parts to be plated are suspended in a vacuum chamber in which cadmium is vaporized, the vapor plates the objects as it condenses on them. This method requires no electric current to effect plating and is conducted at room temperature.

A new-type battery was developed in which beta-particle radiation from promethium-147 provides the energy for operation. A phosphor containing cadmium sulphide absorbs the beta particles causing it to produce red and infrared light which is picked up by silicon photocells and changed to electricity. A subcritical nuclear reactor has been developed which employs cadmium in its operation as a one-way valve. Neutrons supplied from a source, such as radium-beryllium, activate the device. In operation, neutrons enter a uranium fuel zone where fission occurs and fast neutrons are produced. The fast neutrons pass through a cadmium barrier zone into a moderator zone where they are slowed down to become thermal neutrons. The thermal neutrons are absorbed in an adjacent fuel zone where fission occurs and fast neutrons are again produced. Any of these fast neutrons which attempt to return to the preceding fuel zone are slowed down in the moderator and absorbed in the cadmium barrier. The cadmium passes neutrons only in the direction away from the initial source•

Zirconium

F. W. Wessel
U.S. Bureau of Mines

THE YEAR 1957 saw a rapid expansion in production and productive capacity for zirconium and hafnium. At the beginning of the year, 76 nuclear reactors were contracted for or under construction (the third nuclear-powered submarine was launched in May), and demand for zirconium was strong in spite of competition from stainless steel. Four new producing plants started operating, and melting and fabricating capacities were increased sharply. Sales of zircon concentrates decreased due to weakened demand from foundries.

Production scored a major gain during the year. From a production of 238 short tons in 1956, preliminary estimates showed that output of reactor-grade metal during 1957 may have exceeded the average rate of 1,200 tons per year required by AEC contracts. Four companies produced zirconium. Carborundum Metals Corp. operated facilities at Akron, N. Y. at full annual capacity of 163 tons, and during the year its new 600-ton plant at Washington, near Parkersburg, W. Va., started production. Wah Chang Corp. continued to make zirconium at the annual rate of 175 tons at its leased facilities in Albany, Ore. Construction of its own plant, also in Albany, was completed and production begun in late March at the rate of 150 tons per year. The capacity of the latter plant has since been increased twice, the final figure being 275 tons annually. Both Carborundum Metals Corp. and the Wah Chang employ the Kroll process in their operations.

The newly-built plant of the United States Industrial Chemicals Co., at Ashtabula, Ohio, functions on a modified Kroll process: sodium has been substituted for magnesium as the reducing agent. It was hoped that the resultant sodium salts could be leached from the sponge, thereby eliminating the costly vacuum-distillation step; however, leaching proved unsucessful, and sodium removal by induction melting is now being appraised. At this plant zirconium is produced in "platelets"—small, thin disc-like pieces —which may be marketed directly, or be compacted readily for melting into ingots. Plant capacity is 1,000 tons per year, of which one-half is reactor grade. Delivery of metal under AEC contract started about mid-year. Also newly constructed was the 350-ton plant of Columbia-National Corp. at Milton, near Pensacola, Fla., which started production early in autumn. This operation purchases local zircon concentrate, fusing it with caustic soda, and removing the hafnium by liquid-liquid extraction before chlorination of the zirconium.

Experimental work is going on at the Bedford, Ohio, operation of the Allied-Kennecott Titanium Corp., where the fused-salt electrolytic process of the Horizons Titanium Corp. is under study.

Receipts of metal under a barter arrangement with Japan were interrupted late in the year by a fire which seriously impaired Japanese productive capacity.

Fabrication and ingot production of zirconium has become a sizable industry. Allegheny Ludlum Steel Corp., Chase Copper & Brass, Firth Sterling, Inc., Lukens Steel Co., National Cylinder Gas Co., Oregon Metallurgical Corp., Reactive Metals, Inc., and the Superior Tube Co., were the leaders in expansion programs which will carry domestic melting capacity from 300 tons early in 1957 to a currently-planned 1,700 tons, with fabricating capacity to match.

Price on the open market held steady throughout most of the year. Quotations were, for reactor-grade metal, $7 to $14, and for commercial-grade metals $5 to $10 per lb, depending on the size of the order. Late in November, Carborundum Metals Co. announced a reduction in price of reactor-grade metal to $7.50 per lb in half-ton lots.

The price stipulated on various AEC contracts ranges from $4.50 to $12, at an average price of $6 per lb. Japanese metal bears a nominal average price of $10.50 per lb.

Hafnium production as a zirconium by-product continued to grow proportionately to the production of reactor-grade zirconium. One manufacturer, using the standard liquid-liquid separation at the beginning of the year, announced its intention to convert, before the year's close, to the disproportionation technique developed in Australia. In this process, zirco-

nium tetrachloride is selectively reduced to the trichloride; the hafnium tetrachloride is then sublimed and a separation thereby effected. The company intends to offer hafnium sponge on the open market at $25 per lb.

Domestic zircon concentrates maintained constant prices throughout the year: For 66% grade, $50 to $55 per short ton, delivered. Quotations on foreign 65% grade held at $64 to $68 per long ton, c.i.f. Atlantic coast ports until mid-year; the price then declined gradually to about $50. The London market was inactive, and prices weakened in September. U.S. imports from Australia increased sharply during the middle third of the year; the indicated annual rate is over 45,000 tons. Imports of zirconiferous materials from Brazil practically ceased as a result of that government's export restriction on radioactive ores. Some zircon concentrate appeared as a co-product of monazite from a dredge operated on a tributary of the Savannah River near Bath, S.C., by Marine Minerals Division of Crane Co.

Outlook for zirconium and its ores and compounds for the near term was for modest increases in demand as a result of construction of additional nuclear reactors, and a gradual price decrease. Demand should not strain present productive capacity. It is estimated that 20,000 tons of stainless steel will be used annually in the atomic field in successful competition with zirconium. Several utility companies at the year's end were considering delaying for three years their plans for ordering atomic power plants, in order to observe critically those already in operation.

During most of the year the market for zircon was weak, principally because of a sharp drop in demand from the foundries; demand for zircon for ceramic and refractory use remained strong. Foundry demand probably will revive as the orders for castings improve.

The long-term outlook for zirconium is for gradually increasing demand from civilian sources as more becomes known about the economic operation of power reactors, and as uses based on zirconium's valuable resistance to corrosion grow in importance. Gradual price reduction should stimulate new uses. The latter observation is also true for hafnium. The zircon market should become firmer as the demand for foundry uses revives, and as requirements for metal production take an increasingly large and reasonably stable part of the available supply•

Antimony

Abbott Renick
U.S. Bureau of Mines

THE 1957 SUPPLY of primary antimony available for industrial consumption was expected to total 12,000 short tons, compared with 14,600 tons in 1956. From actual primary consumption data for the first nine months of 1957, it is estimated that the industrial consumption of primary antimony decreased 20% from the 12,900 tons in 1956.

Domestic mine production of antimony was about 650 short tons in 1957, compared with 590 tons in 1956. Sunshine Mining Co., at Kellogg, Idaho, was the principal producer. The antimony is produced as a by-product of a silver concentrate from ores containing tetrahedrite. The Government contracted to purchase about $1-million of antimony metal from the Sunshine Mining Co. for the national stockpile and called for delivery of 1,500 tons of metal over an 18-month period starting in the third quarter of 1957. Sunshine Mining has developed a process for refining the impure cathode antimony metal which it has been producing in its electrolytic antimony plant.

U.S. smelter production was estimated at about 10,200 tons, virtually unchanged from 1956. In addition about 2,200 tons of antimony in antimonial lead was recovered from domestic and foreign silver and lead ores by primary lead refineries—2,100 tons came from the same source in 1956. Recovery of secondary antimony was expected to approximate 23,000 tons, 5% below 1956.

Antimony Statistics

(Short tons)

	1957 estimated	1956
Domestic mine production	**650**	590
General imports	**16,200**	12,500
Consumption of primary antimony	**10,400**	12,900
Average price of primary antimony metal, RMM brand, in bulk, 99½%, f.o.b. Laredo, cents per lb	**33.00**	33.00

General imports of primary antimony (ore and concentrate, metal, oxide and sulphide were estimated at 16,200 tons of contained antimony, compared with 12,500 tons in 1956. Based on data for the first nine months of 1957, Mexico, Union of South Africa and Bolivia supplied 86% of the ore and concentrate; United Kingdom, Yugoslavia, Belgium-Luxembourg and Mexico 89% of the metal; U.K. 69% of oxide.

Price of domestic metal, RMM brand, f.o.b. Laredo, Tex., in car lots, remained unchanged from August 1955, at 33c per lb. Average New York price for metal, RMM brand, in cases was 35.09c per lb, compared with the 1956 average of 34.97c. Foreign brand quotations on Nov. 18 (duty paid in lots of 5 tons or more) were as follows (cents per lb):

99.6%	26.00 to 27.00
99.5%	25.50 to 26.50
99.0%	25.00 to 26.00

Demand for antimony in the form of Bolivian chemical grade ore was weak in 1957. According to *E&MJ Metal and Mineral Markets*, prices for minimum 65% lump ore decreased from $3.90 to $4.00 per unit in January to a level of $2.90 to $3.00 for the same grade in November. The price prevailing in November for refined antimony trioxide, carload lots, 50 lb bags, was 27 to 29c per lb, f.o.b. shipping point; less than carload lots 28½ to 30½c per lb.

On Nov. 4, 1957 the Department of Agriculture added antimony to the CCC barter list.

Outlook. Only comparatively negligible amounts of primary antimony have been produced in the U.S. during recent years from domestic ores. However, primary antimony is not in short supply. World production exceeds industrial requirements; and adequate supplies will continue to be available to the U.S. in the foreseeable future, assuming there is no political interference with current sources of supply•

MINOR METALS

Beryllium

Donald E. Eilertsen
U.S. Bureau of Mines

TWO NEW BERYLLIUM PLANTS were erected in 1957, one by the Beryllium Corp. at Hazelton, Pa., and the other by Brush Beryllium Co. at Elmore, Ohio. These plants were built in response to a contract each firm received from the Atomic Energy Commission in 1956 for annual delivery of 50 tons of reactor-grade beryllium over a period of five years at a price of approximately $47 per lb.

Beryllium has been identified in approximately 50 minerals, but beryl, when pure, containing about 14% beryllium oxide (BeO) or 5 percent beryllium (Be), is the only one found in sufficient quantity to qualify as an ore of beryllium. It is obtained from pegmatites. Crystals of beryl must be large enough to allow hand-sorting because other methods to concentrate the mineral more economically have not yet been developed.

Research. During the past several years, the Bureau of Mines has conducted research studies to develop methods for recovering small particles of beryl and other important industrial minerals and metals from domestic pegmatites. At the Bureau's Rapid City Experiment Station, Rapid City, S. D., beryl concentrates containing 3.5 to 12.3 percent BeO was made from non-lithium pegmatite rock containing 0.01 to 0.35 percent BeO. On re-treatment of the low-grade concentrate, a commercial-grade beryllium product was made. Studies on extraction of beryllium from high-grade beryl and flotation concentrate of medium beryllium content have been made, and a procedure has been developed that yields 90 percent recovery of beryllium. At the Bureau's Southern Experiment Station, Tuscaloosa, Ala., studies have been made on recovering beryl and other minerals from lithium-bearing pegmatites of North Carolina which contain about 8 lb beryl per ton of rock. Products containing 3% to 5% BeO have been produced, and subsequent re-treatment of the concentrate has enabled production of commercial grade beryl. The results obtained so far by U.S. Bureau of Mines research on beryl flotation and beryllium extraction are promising, but more work has to be done to simplify and improve procedures. Tests will also be made using other beryl-bearing samples obtained from various parts of the U.S.

Beryl Statistics

(Short tons)

	1957 estimated	1956
World production, approximate	7,500	12,500
U. S. mine shipments	460	460
U. S. imports	6,800	12,371
Total new supply	7,260	12,831
Consumption	4,600	4,431
Avg. price of domestic beryl	$514	$514.25
Avg. price of imported beryl	$360	$360.47

Outlook. At the close of September 1957, only 1,581 short tons of beryl were bought, so far, on the Government's domestic beryl purchase program which terminates in June 1962, or when purchases of beryl total 4,500 short tons, whichever occurs first. DMEA will continue to encourage exploration for domestic beryl.

The outlook for beryllium is good. Beryllium is not only being used for production of alloys and compounds, but large quantities of metallic beryllium have found new use in nuclear applications•

Thorium

James Paone
U.S. Bureau of Mines

THORIUM-MAGNESIUM ALLOYS used more thorium than all other non-energy uses of the commodity during the year. Accompanying the increased non-energy consumption, five major nuclear reactor projects which contemplate the use of thorium were under way during the year.

Thorium requirements were met by production from domestic and foreign sources. Monazite, the ore mineral of thorium, was produced domestically in Florida by Humphreys Gold Corp., Jacksonville, Fla., and by Florida Ore Processing Co., Sharonville, Ohio; in South Carolina by Heavy Minerals Co., Aiken; and in Idaho by Porter Brothers Corp., Boise. Minor production was also reported from Cripple Creek, Colo. and from the Hall Mountain area, Idaho. Monazite was produced in Australia, Brazil, India and the Union of South Africa. The Blind River area of Ontario, Canada, known for its valuable uranium ore reserve, is now also considered one of the most important potential sources of thorium on the North American continent.

Thorium Metal

(Price per gram)

	Less than 200 grams	More than 200 grams
Powder	$0.45	$0.35
Unsintered bars	.50	.40
Sintered bars	.65	.50
Sheet, 0.005 in. or more	.75	.60
Sheet, 0.002 in. to 0.0049 in.	.85	.85

Principal producers of refined thorium compounds included Lindsay Chemical Co., West Chicago, Ill.; Rare Earths, Inc., Division of Davison Chemical Co., W. R. Grace & Co., Pompton Plains, N. J.; Maywood Chemical Works, Maywood, N. J.; and Heavy Minerals Co., Chattanooga, Tenn. Mallinckrodt Chemical Works, St. Louis, Mo., recovered some thorium from Idaho euxenite concentrate processed primarily for uranium, columbium and tantalum. Commercial producers of thorium metal included Westinghouse Electric Corp., Lamp Division, Bloomfield, N. J., and Metal Hydrides, Inc., Beverly, Mass. National Lead Co. in Ohio produced metal for the AEC.

Davison Chemical Co.'s $2-mill on rare-earth plant at Curtis Bay, Md., built specifically to extract thorium salts from monazite sands, shut down after a short period of operation due to processing difficulties.

Current price for 10% thorium concentrate was reported at $1.00 per lb of ThO_2 content in thorite ores. Prices for thorium contained in monazite remained stable during the year.

Annual Thorium Consumption in Atomic Reactors

(In kilograms)

Designation	Company or firm	Fuel	Thorium in reactor	Annual consumption
CETR	Consolidated Edison of New York	U_{25} alloyed with Zr	9,700	125
SGR	Atomics International	U_{25} with Th	8,100	72 to 90
HRT(HRE-2)	ORNL	UO_2SO_4	—	—
LMFR	BNL and Babcock & Wilcox	U in Bi	21,000	180

Thorium Compound Prices

(In 100-lb lots)

	Per cent ThO_2	Price per lb
Carbonate	80-85	$7.25-8.80
Chloride	50	7.00
Fluoride	80	6.50
Nitrate (mantle grade)	46	3.00
Oxide	97-99	8.25-9.35

Reactor-grade (99.9% purity) thorium metal was offered for sale by the Government at a price of $43.00 per kg ($19.55 per lb) and the Commission established a "buy-back" price for uranium-233 (the fissionable material made from thorium) at $15.00 per gram of uranium for the material produced abroad through the use of the fuel obtained from the AEC under cooperative agreements.

In the magnesium-thorium alloy field, Dow Chemical Co. announced the successful development of a new sheet and plate alloy designated as "HM21XA-T8"; it is the second in a series designed by Dow to meet a critical defense need for a structural airframe material that combines light weight and strength with the property of withstanding intense heat generated by friction at supersonic speeds. Most aircraft manufacturing companies are now using or are contemplating the use of thorium-magnesium alloys. Details of the construction and operation of the earth satellite, Project Vanguard, revealed that the second-stage rocket skin will be of a magnesium-thorium alloy. Annual consumption of thorium in alloys in 1957 is reported to have increased about 1,000% over the first reported figure of 3,600 lb in 1953.

Manufacture of gas mantles during the year consumed about the same quantity of thorium as in 1956. Other non-energy uses, such as refractories and polishing compounds, chemical and medical, and electrical, also consumed about the same quantity of thorium as in the previous year.

Thorium's role in atomic power was under investigation during the year. The five major reactor projects involving thorium include four types of reactors.

Some $4-million a year is spent by the AEC on research on thorium. Estimates of a reasonably firm demand for thorium in nuclear energy applications during the next several years by domestic and foreign users is on the order of 10 tons of metal annually; needs for thorium in Government are met by AEC.

Outlook for thorium in magnesium alloys is promising as is the continued demand for thorium nitrate for gas mantles. The new alloy, HM21XA-T8 can better withstand high temperatures than any aluminum or magnesium alloy in use. Developed primarily for defense products for the Air Force, the thorium-magnesium alloys are gaining in popularity among most aircraft manufacturers.

Present enthusiasm for earth satellites and space travel will undoubtedly have a marked effect on the consumption of thorium, inasmuch as it appears to be a suitable material in the manufacture of rocket skins and airframes.

Technical obstacles to its use in nuclear energy make the widespread use of thorium in the near future a much less likely possibility than is the case with uranium. Thorium appears to have an important role in the nuclear power program but the quantities used per year will not be large for some years to come•

Rare Earths

Howard E. Kremers
Lindsay Chemical Co.

MONAZITE ORE from the Union of South Africa continued to be the chief source of domestic rare earth and thorium production. Government contracts for thorium chemicals, together with increased thorium chemical production for non-energy uses, has resulted in a continuing surplus of crudes of the lighter rare earths.

Domestic ore production has come from the bastnaesite deposit at Mountain Pass, Calif. operated by the Molybdenum Corporation of America and from the Horse Creek sand placers near Aiken, S.C. operated by Heavy Minerals Co. Minor amounts of monazite sand were produced as a by-product of ilmenite-rutile-zircon mining in Florida, and as a by-product of euxenite mining at Bear Valley, Idaho.

Rare earth ores containing predominantly the heavier rare earths were mined on a limited scale in Colorado, and euxenite continued to be recovered from the Porter Brothers' deposit at Bear Valley, Idaho. Some xenotime was recovered from the Heavy Minerals operation in South Carolina.

Processors. Lindsay Chemical Co., Michigan Chemical Co., Heavy Minerals Co., and Davison Chemical Co., Pompton Plains, N. J., continued to be dominant in the commercial ore processing phase. The Baltimore plant of Davison Chemical Co. closed before the completion of their Government contract to process stockpiled monazite. Mallinckrodt Chemical Works processed Idaho euxenite to recover uranium, columbium-tantalum, and thorium-rare concentrates for GSA. Molybdenum Corp. continued to produce rare earth concentrates from bastnaesite for metallurgical use.

Several smaller concerns processed small amounts of ore to produce the heavier separated rare earths.

Prices. Monazite prices averaged about $250 per net short ton delivered for large contract tonnages of ore containing 6% ThO_2 and 45% rare earth oxide. Small lots of monazite sand sold at varying prices down to $25 to $30 per stu ThO_2 content.

Rare earth oxides from bastnaesite continued at $1 per lb, and misch metal in standard forms sold for $3.15.

Prices for ore concentrates of the heavy rare earths were variable with a downward trend.

Prices for commercial quantities of rare earth products produced from monazite held fairly constant, although there were declines in some items.

Prices for separated purified rare earth materials continued to drop sharply in nearly all cases due to increased production capacity and efficiency and to competition. Some highly purified rare earth materials, particularly the heaviest rare earths, saw price reductions amounting to more than $100 per gram. The downward price trend for these items will probably continue.

Research production methods and use applications continued in industry, research and Federal groups. Industrial research by the rare earth processors was aimed chiefly at better production methods and lower costs.

Techniques for flame spraying rare earth oxide coating on metal surfaces were developed. These coatings improve resistance to corrosion and are oxidation catalysts.

In the metal and mineral processing field, use research is being continued by suppliers of misch metal and metallurgical grade rare earth compounds. Although most alloy applications involve the use of mixed rare earths, more emphasis is being given to studies of the effect of the individual rare earths.

Research on rare earth garnet ferrimagnetic materials made rapid progress. These materials have potential use in microwave electronics. Garnets of gadolinium, yttrium and erbium offer the most promise. A new rare earth metal getter was developed for electron tubes.

More consideration was given to the use of rare earths of high thermal neutron cross section (primarily europium and gadolinium) for control rods in nuclear reactors. This work resulted in substantial productive increases of these rare earths as metals.

Use applications continue to be investigated largely by the final user rather than by the processor. Late in the year a long range use research program sponsored by seven rare earth processing companies was started by Battelle Memorial Institute.

Outlook. Improved production technology and adequate raw material supplies improved the future outlook for rare earths. Domestic ore supplies are adequate, and new ore deposits continue to be found and developed.

Through industry advertising, the fallacy of the scarcity of these materials is being pointed out, and more interest is being shown in these materials. Production capabilities presently are in excess of demands. Competition has resulted in improved production at lower prices, and will continue to play a dominant role in the future of rare earths•

Platinum Metals

J. Patrick Ryan
U.S. Bureau of Mines

RECORD WORLD PRODUCTION, declining demand and growing oversupply featured the platinum metals industry in 1957. The supply-demand situation was a reversal of the situation prevailing throughout most of 1956 when domestic consumption reached an all-time peak. Reflecting the falling off in demand and increased world supply, platinum prices dropped from a high of $103-$107 per oz troy in January to a low of $77-$80 per oz in December 1957.

Foreign countries continued to supply the bulk of U.S. platinum metals requirements which comprised more than two-thirds of world output. Domestic production consisting of crude platinum from Alaska placers, by-product platinum metals from copper and gold refining, and platinum metals recovered from secondary sources supplied about 15% of the domestic requirements. Increased quantities of Russian platinum reaching the market during the year were a contributing factor in lowering the price of the metal.

The principal market for platinum in 1957 continued to be the petroleum refining industry, where platinum catalysts are used to upgrade low-octane petroleum naphthas; however, sales to the industry dropped considerably during the year. Platinum metals and alloys were used extensively in the electrical industry especially for contacts; consumption of palladium in particular continued near the high level of last year, reflecting sustained demand for contacts in telephone relays and other electrical regulating equipment. Sales of platinum metals for use in jewelry and the decorative arts, and for dental and medical applications were lower in 1957.

Platinum Group Statistics

(Thousands of troy ounces)

	1957 Nine months	1956 Nine months
Platinum Group		
Imports	540.5	777.0
Domestic refined	69.8	101.2
Domestic use	540.9	625.9
Platinum		
Domestic sales and exports	268.2	318.3
Imports and domestic refined	282.7	384.4
Palladium		
Domestic sales and exports	276.5	319.5
Imports and domestic refined	301.3	464.3
Iridium, Osmium, Rhodium, Ruthenium		
Domestic sales and exports	30.0	23.1
Imports and domestic refined	26.2	29.4

World output of platinum metals in 1957 is estimated to have reached a record high of about 1-million oz troy distributed approximately as follows: Union of South Africa, 500,000 oz troy; Canada 350,000; Soviet Union 105,000; Colombia 25,000; U.S. 20,000.

Domestic consumption of platinum in the first 9 months of 1957 was 253,800 oz, of which about 73% was used in the chemical industry (including petroleum refining); 15% electrical; 2% dental and medical; 9% jewelry and decorative and 4% miscellaneous. The price of platinum declined steadily from a high range of $103-$107 per oz troy at the beginning of the year to $81-$87 per oz in the middle of August where it remained unchanged until early in December when the price again was reduced to $77-$80 per oz.

Palladium sales in the first nine months were 267,100 oz distributed as follows: Chemical 8%; electrical 80%; dental and medical 5%; jewelry and decorative 5%; and miscellaneous 2%. The price of palladium remained unchanged at $23-$24 per oz troy until the last week in June, after which

it was lowered to $21-$22½ per oz for the remainder of the year.

Sales of iridium, osmium, rhodium, and ruthenium aggregated 14,100 oz in the first half of the year. Prices per ounce troy for the four metals remained unchanged at $100-$110, $80-$100, $118-$125, and $45-$55, respectively.

The near term outlook for platinum is for continued oversupply with demand leveling off, then slowly rising as new gasoline reforming plants under construction or planned in the U.S. and Europe come into production and require platinum catalyst. Recently developed applications for platinum also will lead to increased consumption and alleviation of the oversupply situation. Promising new applications include the use of platinum anodes in automatic electrical systems for protecting ships' hulls and propellers against corrosion, platinum "glow plugs" as reignitors in preventing "flameout" in jet engines, and platinum in permanent magnets.

The Free World future supply position for platinum metals was substantially improved by the development of new reserves and the expansion of existing production facilities by Rustenburg Platinum Mines in South Africa. Also, the development of large reserves of platinum-bearing nickel deposits by International Nickel Co. in Canada and the completion of new production facilities scheduled for 1960 will contribute greatly to assuring an adequate long-term platinum metal supply•

Lithium

Marshall Sittig
American Lithium Institute

EMPHASIS in the lithium industry in 1957 was on creation of new markets. There are more than adequate ore supplies, the tin-spodumene belt in North Carolina alone containing enough ore to supply the industry for 50 years at present production rates. Thus, with substantial production facilities in full operation, emphasis shifted from production to sales in the past year.

World production of lithium chemicals continues at a rate sufficient to meet all foreseeable demands in the immediate future with producers in:

The U.S. American Potash & Chemical Corp. at Trona, Calif. and American Lithium Chemicals—51% owned — at San Antonio, Tex.; Foote Mineral Co. at Sunbright, Va.; Lithium Corporation of America at Bessemer City, N.C.; Maywood Chemical Works at Maywood, N.J.

Brazil. Orquima at Sao Paulo.

Africa. Lithium Products, Ltd. in Gwelo, Southern Rhodesia

England. Associated Lead Manufacturers, Ltd. in Liverpool; Kemball-Bishop & Co., Ltd. in London

France. Rhone-Poulenc in Paris; Prosimacfi in Chauny

Germany. Hans-Heinrich-Hutte, G.m.b.h. (Metallgesellschaft subsidiary) in Frankfurt

U.S. production statistics (by far the major producer) continue to be unavailable due to the classified uses of lithium. The nature of one of these classified uses was revealed for the first time in 1957 when the U.S. AEC revealed that it was purchasing virgin lithium hydroxide, was processing it to separate the lithium-6 isotope for its own use (quantities and use remain classified), and was then returning lithium hydroxide rich in lithium-7 to a stockpile available for repurchase by the suppliers of the virgin material.

Within the industry, major emphasis has been on the expansion of facilities to produce metallic lithium. Prior to 1956, only Maywood Chemical Works and Lithium Corporation of America produced the metal. Foote Mineral Co. began its manufacture in 1956. Now, 1957 has seen three developments:

(1) The entry of American Potash & Chemical Corp. into lithium metal manufacture at their Henderson, Nev. plant.

(2) A major expansion of metal-producing facilities by Lithium Corporation of America at their St. Louis Park, Minn. plant.

(3) The entry of Dominion Magnesium, Ltd. of Toronto into metal manufacture at their Haley plant.

Not only has production emphasis been on the metal, but much research and development emphasis as well.

On the use of lithium in aluminum alloys, Aluminum Company of America in October 1957 announced a lithium-aluminum alloy designated X-2020 which increases lightness by 3%, elastic modulus by 8%, and permissible operating temperature by 100 deg F over conventional aluminum alloys. Applications in supersonic aircraft are foreseen.

Other work has been done on the synthesis of high-energy boron hydride fuels using lithium hydride (made from lithium metal and hydrogen) as one raw material in a reaction with boron halides.

On the possible application of liquid lithium metal as a heat-transfer agent in nuclear aircraft two things will be necessary: (1) separation of the pure lithium-7 isotope from the mixture of lithium-6 and lithium-7 which is the usual commercial metal, and (2) preparation of very pure metal with nitrogen and oxygen contents very low in parts per million. This latter requirement demands among other things better analytical techniques than are available today.

Use of lithium metal, or of alkyllithium compounds, such as butyl lithium (made from the metal) in the manufacture of new polymers such as the cis-polyisoprene, which is a true synthetic counterpart of hevea tree rubber is also under study. The predicted shortage of natural rubber makes the market for the synthetic natural look very attractive, but the outlook for lithium use is tempered by the fact that only 0.01% of catalyst is required.

Commercial use today is in organic synthesis (in making synthetic Vitamin A, for example) and in metallurgy (in deoxidation of OFHC copper) but the king's share of the uses of lithium are not as the metal, but as lithium chemicals.

Thus, lithium hydroxide continues as the largest single product of the industry, with most of it going into the manufacture of multi-purpose lubricating greases by the petroleum industry. These lithium stearate greases constitute one-third of the total automotive grease market.

Lithium carbonate is the second most important product of the industry, with most of it going into the manufacture of frits for the porcelain enamel industry and into other glass and ceramic applications.

Lithium halides are next in importance, with the bromide and chloride important as absorbent brines in air-conditioning, and with the chloride and fluoride important in welding and brazing fluxes for aluminum, magnesium and zirconium.

Tomorrow's end use picture will put heavier emphasis on the metal, perhaps making it the industry's number one product in years to come, through the research avenues outlined above. Aside from steady growth of today's established uses, lithium compounds may find commercial use tomorrow as fungicides in agriculture, as additives in cell baths for the electrowinning and electrorefining of such metals as aluminum and titanium, to mention just a few exciting, new possibilities.

The year 1957 has seen the first full year of operation of the American Lithium Institute, Inc., jointly sponsored by American Potash & Chemical Corp., Foote Mineral Co., and Lithium Corp. of America. A monthly newsletter giving abstracts of periodical, patent and Government report literature has been initiated. Work is well along on the first really comprehensive treatise on lithium and its compounds, and this will be published as an American Chemical Society Monograph in late 1958•

Boron

Peter Colefax
American Potash & Chemical Corp.

THOUGH PUBLISHED FIGURES are not available, it is probable that the rising trend of borate production did not continue through 1957. Based on the general level of business of major borate consumers, it seems likely that the total consumption of borates remained static or possibly fell off a little during the year. This leads to the conclusion that production rates remained about the same as in 1956 with very likely some increase in year-end inventories.

There was apparently little change in production of borates outside of the U.S. Relatively small tonnages were produced in Turkey, Italy and South America. Such production probably totals less than 5% of the gross world production.

Borate prices were firm through 1957. A price increase took place at the beginning of 1958.

No significant developments were reported with respect to the operations of American Potash & Chemical Corp. or Stauffer Chemical Co. at Searles Lake. U. S. Borax & Chemical Corp. changed over from underground mining to open-pit mining and transferred its refining operations to its new refinery at Boron, Calif., late in the year. California Borate Co. is believed to have completed its development work, but has not commenced production of ore on a commercial basis.

It was disclosed during the year that the high-energy fuels, about which there had been so much speculation during the previous year, were in fact compounds containing boron, carbon and hydrogen. Navy announced that Callery Chemical Co. would build a $38-million Navy-sponsored plant for production of high-energy fuel at Muskogee, Okla. Callery Chemical also announced that it would build a small plant of its own for production of boron hydrides and related chemicals. Air Force announced that Olin-Mathieson would construct a plant at Niagara Falls for the USAF. This facility for production of boron-based liquid high-energy fuel is expected to be comparable in cost with the Navy-owned facility.

AFN, Inc., a new corporation in which the stockholders are American Potash & Chemical, Food Machinery & Chemical Corp., and National Distillers & Chemical Corp., announced that it was proceeding with a process development contract relating to production of boron-based high-energy fuel on behalf of the Air Force.

Completion dates of the two fuel plants are announced as late 1958 or early 1959. Hence it is evident that these developments in themselves will not significantly affect borate consumption in 1958. What the effect may be on future requirements is still a matter of speculation, as the potential use of such new fuels cannot be estimated with any accuracy until these first plants are producing sufficient fuel to permit full-scale testing.

The speculative potential of the high-energy fuels has resulted in considerable investor interest in the companies involved in borate or high-energy fuel production and has also led to increased interest in exploration for borates. At least two companies have announced drilling programs in the Mohave Desert area, and there has been a rush on the part of individuals to apply for sodium prospecting permits on Government lands. There is little geological basis to guide such prospecting other than to seek locations in which geological conditions are in general similar to those at the Kramer and Searles Lake deposits. Some attempts have been made to apply geophysical approaches but, so far as is yet known, with no positive results.

Public interest in boron was also stimulated by promotional campaigns instituted by two licensees of Standard Oil of Ohio with respect to "boron gasolines." The amount of boron involved in this use is, however, relatively small.

While by far the major portion of borate output has been sold as sodium tetraborate in its various forms (decahydrate, pentahydrate, anhydrous) or as boric acid, there has been steadily increasing interest in less well known boron compounds.

Elemental boron, various borate esters, and boroxines have enjoyed a modest increase in consumption. Boron trichloride was offered at reduced prices following construction of a small commercial unit by Stauffer Chemical and announcement of the availability of pilot-plant quantities by American Potash & Chemical. The latter simultaneously announced availability of development quantities of boron tribromide.

In the boron hydride field aside from the high-energy fuel developments, American Potash offered development quantities of decaborane; while Callery Chemical offered several amine addition products of diborane.

Research. American Potash, Callery Chemical, and U. S. Borax are all currently carrying on substantial research programs in the organo-boron field; and while there have been no developments of major commercial significance as yet, this activity points to ultimate significant increases in dollar sales of boron-derived products even though the increase in tonnage due to such new products may not be large•

Ferroalloy Metals

Hubert W. Davis
Commodity Specialist
U.S. Bureau of Mines

"Supplies of nickel in 1958 are expected to be adequate for both defense and civilian needs . . . about the same [amount] as in 1956 and 1957 . . . 15,500 short tons of cobalt were produced in 1957."

Wilmer McInnis
Commodity Specialist
U.S. Bureau of Mines

"Outlook for 1958 chromium is little different from 1957: . . . imports may decrease . . . use will be . . . unchanged. In 1958, molybdenum production will be ample for both domestic and foreign needs."

Robert W. Holliday
Commodity Specialist
U.S. Bureau of Mines

"Tungsten use and prices are virtually certain to rise . . . In the immediate future supplies of concentrate will be plentiful . . . An increased tendency to process concentrate abroad is developing."

George E. Drake
Vice President
Electro Metallurgical Co.

"The predicted decline in steel for 1958 will be an important factor for the coming year for vanadium. 1957 consumption was down, primarily for ferrovanadium. Pure vanadium metal shows great promise."

J. R. O'Connell Jr.
Assistant Market Editor
E&MJ

"There is currently no manganese ore market . . . Business is at its worst in years . . . With Amapá in full swing, the supply prospect for 1958 is a disturbing one to many ore sellers."

Nickel

Hubert W. Davis
U.S. Bureau of Mines

THE SUPPLY-DEMAND POSITION of nickel for civilian needs in 1957 was much improved over 1956 as a result of diversion to industry of virtually all scheduled shipments to the national strategic stockpile. Because of the improved supply position, some consumers turned down part of their allotments of nickel, and stocks (48-million lb) held by consumers on Sept. 30 were 89% greater than at the beginning of the year.

Office of Defense Mobilization announced that the nickel expansion goal, aimed at providing an annual U.S. supply of 440-million lb nickel by 1961, had been closed. ODM also announced that about 135-million lb of nickel, both market and premium price, scheduled for shipment to the Government stockpile in 1958, would be made available to the civilian economy.

Nickel Statistics

(Short tons)

	1957 estimated	1956
United States		
Imports	148,000	142,642
Consumption	128,000	127,578
Canada		
Production	190,000	178,515
Exports	179,000	176,837
Cuba		
Production	22,500	16,062
Price per lb electrolytic nickel in car lots, Port Colborne, Ont., including duty of 1¼c	74c	64½ to 74c

Note: Some nickel diverted from the U. S. stockpile was sold at a higher price.

Production. Free World production of nickel is estimated at 248,000 short tons in 1957, a gain of 7% over 1956. Canadian output during the first nine months was 143,123 tons (up 7%), and exports were 134,060 tons (down 0.2%). Output of nickel oxide powder and oxide sinter in Cuba was 18,078 tons (nickel content) in the first 10 months of 1957 (up 35%).

Imports of nickel into the U.S. were 110,000 short tons in the first nine months of 1957, up 3%. Imports from Canada and Cuba were up 1% and 25%, respectively, but those from Norway were down 18%. Receipts from Japan decreased from 1,171,000 lb to 555,700 lb; those from West Germany from 570,000 lb to 351,600 lb; and those from United Kingdom from 633,000 lb to 168,000 lb. No imports were received from France during the first nine months, compared with 133,000 lb in the corresponding period of 1956.

Despite a 75-day strike at one of the largest consuming plants, U.S. consumption of nickel during the first 10 months of 1957 was about 106,000 short tons, or 3% more than in the corresponding period of 1956. Usage of nickel during the last two months of 1957 was expected to be smaller than in the corresponding period of 1956 and as a result total consumption in 1957 will probably be about the same as in 1956—127,600 tons. Usage in cast irons, high temperature and electrical resistance alloys, and catalysts, and for electroplating was greater, but these gains were offset by smaller consumption in engineering alloy steels, stainless steels, nonferrous alloys, ceramics and magnets.

Producers. Output by International Nickel Co. of Canada, Ltd., continued at a high rate in 1957. It made much progress in developing its property in the Mystery-Moak Lakes area in northern Manitoba, where by late 1960 the company expects to have capacity to produce 75-million lb nickel annually; this will be the second-largest nickel mining operation in the world. The 30-mile railroad spur linking the Thompson townsite and the Canadian National Railway's Hudson Bay line at Sipiwesk was completed in October.

Production at mines, smelter and refinery of Falconbridge Nickel Mines Ltd. continued at a high rate in 1957. Production of refined nickel was about 5% greater than in 1956. A marked decline in custom material treated was more than offset by an increase in ore supplied by its own six mines. The Fecunis Lake mill was put into operation on Longvack mine ore. Development of the Fecunis Lake mine was being pushed in anticipation of regular production in 1959. Development work in preparing the Onaping and Boundary mines for production made good progress. Construction of the new smelter proceeded satisfactorily and it was hoped to have it in production before the end of 1957. Nickel refining capacity in Norway was further increased in 1957.

Sherritt Gordon Mines Ltd., was expanding its refinery capacity at Fort Saskatchewan, Alberta, to insure a minimum production of 25-million lb nickel annually to permit handling of concentrate on a toll basis from Western Nickel Ltd., whose mine at Choate, B. C., was being rehabilitated. In addition to refining its own nickel concentrate from Lynn Lake, Manitoba, concentrate from the Nickel Rim mine in the Sudbury district and some nickel matte from abroad were treated on a toll basis.

North Rankin Nickel Mines Ltd., on the shore of Rankin Inlet, Northwest Territories, Canada, began producing nickel concentrate in May. Rated capacity of the mill was reported as 250 tpd. Nickel Rim Mines Ltd., in the Sudbury district, continued to ship magnetic concentrate to Falconbridge and flotation concentrate to Sherritt Gordon. Plans of the Arcadia Nickel Corp., also in the Sudbury district, for beginning production were reported to be progressing satisfactorily. Much publicity was given to important discoveries of nickel-copper deposits in the Ungava area in Quebec Province, where the Quebec government granted exploration permits to many companies.

Output by Nickel Processing Corp. at the U.S. Government-owned plant in Cuba established a new high in 1957 and was about 40% greater than in 1956. The plant expansion program to increase capacity by 75% was completed in March. The Government announced that it intended to dispose of the plant to private industry. The plant represents a net investment by the Government of $85-million and constitutes the second largest nickel-producing operation in the Free World.

Government entered into an agreement with the Cuban American Nickel Co., a subsidiary of Freeport Sulphur Co., to buy up to 271-million lb of nickel metal. Construction of facilities was under way at Moa Bay, Cuba, where the company will produce a high-grade nickel-cobalt concentrate which will be shipped to Braithwaite, La., where a refinery will be built to reduce the concentrate to yield separate products of high-purity nickel and cobalt. Production of nickel metal at the rate of 50-million lb annually was expected to begin in 1959.

Hanna Nickel Smelting Co., Riddle, Ore., produced 33,279,000 lb of ferronickel containing 14,703,000 lb nickel in the first 10 months of 1957, compared with 18,903,000 lb containing 8,634,000 lb nickel in the corresponding period of 1956. Four furnaces were in operation in 1957,

whereas during the early part of 1956 only two furnaces were in production.

Output of nickel metal by National Lead Co., Fredericktown, Mo., during the first 10 months of 1957 was 23% greater than in the corresponding period of 1956.

Outlook. Free World production of nickel will probably increase moderately in 1958. Supplies of nickel in 1958 are expected to be adequate for both defense and civilian needs, which will probably be about the same as in 1956 and 1957•

Tungsten

R. W. Holliday
U. S. Bureau of Mines

PRODUCTION, imports and price of tungsten concentrate declined appreciably in 1957; consumption by U.S. industry was about the same as in 1956 but stocks held by industry doubled.

The suspension of Government purchasing of domestic concentrate continued through the year and domestic producers were in competition with foreign ores for the limited U.S. industrial market. The increase in stocks (3.5-million lb contained tungsten) subtracted from the estimated production (7.5-million lb) indicates a sale to industry of something approaching 4-million lb. Domestic stocks of concentrate, produced for the Government market but not purchased by the Government, undoubtedly acted as leverage for breaking into the industrial market but there was no clear indication that domestic producers could compete on the same scale, costwise, over a long period.

Monthly domestic mine production decreased gradually throughout the year from 70,000 short ton units (WO_3) in January to about 25,000 units in December. As in previous years, the largest tonnage came from relatively few mines. In January, about 97% of output came from the 15 largest producers and by December virtually all of it was from only four mines. Total output was about half that of 1956 but value was only a fourth as high because of lower prices in 1957.

The Hamme mine of Tungsten Tungsten Mining Corp. in North Carolina was the leading producer. Other mines operating throughout 1957 were the Pine Creek mine of Union Carbide Nuclear Co. in California, the Tungsten Group of Nevada-Massachusetts Co. in Nevada, and the Climax mine of Climax Molybdenum Co. in Colorado which produced by-product tungsten concentrate. After February little ore was purchased or milled on a custom basis.

U.S. Tungsten Concentrates

(Thousands of lb of contained tungsten)

	1957 estimated	1956
Production	7,500	14,761
Consumption	8,400	9,061
General imports	15,000	21,857
Industry stocks (end of year)	8,000	4,457

Some U.S. trade journals quoted the price of domestic concentrate throughout 1957 at $55 per stu WO_3 because of the authorization, under P. L. 733, 84th Congress, for continued acquisition at that price by the Government. Actually, however, no such purchases were made and sales to industry were negotiated individually at various prices, presumably in the range paid for imported concentrate.

E&MJ quotations for imported concentrate, c.i.f., U.S. ports, duty extra, declined from $27.25-$27.75 on Jan. 3 to $11-$13 Dec. 19.

Much of the imported concentrate was delivered to the Government under long-term contracts, at prices above the open market quotations.

Consumption of concentrate in the first half of 1957 was over 5-million lb, contained tungsten, but it declined substantially in the last half and the total consumption for the year was below the 1956 figure. Preliminary data indicate that about 41% was utilized for steel and other alloys; 39% for carbides; 13% for pure metal uses; and 7% for chemicals and miscellaneous uses.

Imports of concentrate decreased 30% to an estimated 15-million lb of contained tungsten in 1957 compared to almost 22-million lb in 1956. Curtailed delivery to Government and renewed competition from domestic producers were factors in the lower rate of imports. Bolivia (1,692,358 lb), Republic of Korea (1,539,699 lb), Australia (1,466,941 lb), Brazil (1,428,405 lb), Argentina (1,409,771 lb), Canada (1,317,450 lb), and Peru (1,218,902 lb) supplied 88% of total imports in the first 9 months of 1957. Data for the last 3 months of the year were not available.

World production of tungsten concentrate declined in 1957 because of low prices and declining demand. Several contracts for delivery of concentrate to the U.S. stockpile by foreign producers were completed, presumably increasing the excess productive capacity of the Free World.

Research emphasis was directed largely toward processing and utilization. A program for investigation of the properties of ultra-pure tungsten was initiated by the U.S. Bureau of Mines. Industry and other Government agencies also indicated interest in the problems of producing and testing extremely high-purity materials as a step in development of materials for high-temperature use. Increased interest in the use of tungsten was also fostered by the generally lower prices and the increasing assurance that future raw materials supplies will be available.

Outlook at the end of the year for domestic producers of tungsten concentrate showed little promise of improvement in the immediate future. Government stockpiling for defense purposes was considered adequate. Stocks held by industry (consumers and producers) were about double the quantity usually maintained in recent years and equal to nearly a full year's consumption. Industry specifications were higher than those of the Government stockpile. Costs of foreign producers may have been and will probably continue to be lower than domestic producers because of richer ores, lower standards of living, need for U.S. credit, or other factors.

The long-range outlook for producers is more favorable. Consumption and prices are virtually certain to rise because of increasing population, new technology and limited ore reserves.

Domestic consumers of concentrate can expect that in the immediate future supplies of concentrate will be

plentiful and markets for products will fluctuate with the economy.

The long-range outlook for consumers is that foreign competition for concentrate will increase with increased standards of living in less developed areas. An increased tendency to process the concentrate in other countries is now developing, partly as a result of current surplus.

New or expanded uses could result from current research and greatly improve the outlook for both producers and consumers of tungsten-bearing concentrate•

Manganese

J. R. O'Connell Jr.
Assistant Market Editor

THE MANGANESE ORE MARKET was no exception to the downward trend of the metals industry which continued through the year and bleakly ushered in 1958. Prospects, at least for the first half, are for little improvement in manganese ore demand.

As 1957 began, the outlook for manganese was at least fair. Steel production for the first weeks of the year was brisk, running between 97% and 100% of capacity. Gradually it slipped into the 70's and finished the year, further weakened by the holidays, at about 60% of capacity. This has been largely responsible for the dead market.

Along with the lack of business, the establishment of the Amapa Mine in Brazil stands out as a major development in the world picture. Acceptance of this ore by consumers has added an enormous tonnage to world output. In 1955 general U. S. imports of ore from Brazil were 164,000 tons. In 1956 the figure moved up to 237,218 tons. In 1957 it has been estimated that Brazil shipped between 850,000 to 900,000 tons to the U. S., taking over world leadership in shipments to the U. S. Difference of about 600,000 tons can be traced largely to the Amapa project. It has been estimated that something over 400,000 tons of this went to the U. S. Government in ore payment for financial assistance. Remainder, or about one-third, went to Bethlehem Steel Corp. Some odd lots of Amapa's output were sold in the open market, but the amount was not large.

Observers suggest Amapa will produce between 900,000 and 1-million tons of manganese ore in 1958. Bethlehem, the major consumer among the owners, will doubtless take a large portion. Many feel a sizable amount will remain for sale on the market.

Amapa is owned by Brazilian interests (51%) and Bethlehem (49%). The Brazilians could not finance the operation alone and sought help from the Export-Import Bank. Aid was granted with the provision that a private concern be brought in to match Brazilian money. A corporation (Icomi) was formed. Bethlehem financed its 49% with an Export-Import Bank guarantee. The Brazilians were financed by the bank with a stipulation that the ore debt would be paid off in the first year.

U.S. Manganese Ore Statistics

(Thousands of short tons)

	1957	1956
Production	330	345
Consumption	2,264	2,420
Imports	2,875	2,231
Exports	4	6
Stocks, end	1,450	1,284

As 1958 began, there was practically no manganese ore market in this country. Statistics show inventories of 11 to 12 months on hand, if fourth quarter 1957 consumption figures are considered. Using first quarter 1957 consumption data, inventories would be good for no more than six or seven months, some say. Even if consumption were able to pick up quickly, inventories have been adjudged adequate for seven or eight months. Ore due on many old contracts has still to be added to current inventories.

Sellers report that there are no major buyers interested in first quarter purchases. Only a few have voiced interest in second quarter material. Most consumers have adopted a "wait and see" approach and will say little more concerning second half needs.

There are other depressing factors to go along with the sharp dip in the steel rate. Deliveries are one. Generally, when contracts are made, the buyer will make an allowance for non-delivery of some portion of his total need. This is considered a safe proposition when dealing with many sources. Such reasoning has not applied recently, as might be expected in the weakened market. Shipments have been regular, beyond the needs of many.

Another factor to be considered is the ferro-manganese market, by far the greatest consumer of manganese ore. Demand for ore can be accurately measured by this market. It has been reported that nearly every maker of ferro is stacking some of his furnaces. Some furnaces were forced to shut down in 1957. Normally ferro producers contract for ore at this time of the year. As stated, such action has been indefinitely delayed this year, sellers report.

The supply prospect for 1958, with Amapa in full swing, is a disturbing one to many sellers. It is unlikely the U. S. Government will take anywhere near as much ore as it did in 1957. The Government is not concerned with buying any additional tonnage of manganese ore for stockpiling except an insignificant amount of U. S.-mined low grade ore, but it probably will listen to barter deals for surplus U. S. agricultural products. Such deals may be the only hope for anything resembling an adequate demand in 1958.

India, a major source of ore, experienced a trying year. Indian prices were sky high as the 1957 year began, due to good demand and increased freight caused by blockage of the Suez Canal. Prices eased, but mainly due to decreasing freight rates rather than cuts in Indian asking prices.

Some buyers termed the Indian State Trading Corporation a monopolistic organization aimed at maintaining high prices. Increased amounts of outside ore, slashed demand, and foreign and Indian resistance may well prevent this. Inability of STC to fulfill contracts to the letter, especially during the transportation and port difficulties within the country, provided many buyers with cancellation loopholes. They were able to get ore for less than they had originally contracted—when they needed it.

Indian ore prices per long ton unit of manganese, basis 48% c.i.f. U.S. ports, import duty extra, export duty included, were $1.64 to $1.69 during January and February. In March prices were down to $1.64 to $1.69.

April saw a sharp decline, and *E&MJ* quotes slipped to $1.53 to $1.57. The figure fell to $1.49 to $1.53 in May; in June to $1.45 to $1.49; and this range carried over through July; in August-October it was $1.40 to $1.43. November saw a further drop to $1.36 to $1.39. December was unchanged.

Recently Russia, in an attempt to improve Indian relations, has encouraged Hungary and Yugoslavia to trade heavy equipment for ore. As the year began, a barter deal involving $30- to $50-million worth of ore was being discussed by the U. S. and India.

As it stands, 1958 promises to provide lower prices, lower consumption, and greater supply—all of which indicate continued headaches for the industry. Business, as we go to press, is at its worst in years. It has been said, "There is currently no manganese ore market." Only the consumer can adjust this situation in 1958•

Cobalt

Hubert W. Davis
U.S. Bureau of Mines

Cobalt Statistics

(Pounds)

	Metal		Oxide (gross wt)	
	1957 9 months	1956	**1957 9 months**	1956
U. S. production	**3,696,542**	5,122,571	**512,431**	625,908
U. S. imports	**12,081,286**	12,974,393	**466,320**	828,450
Belgium-Belgian Congo	**7,003,184**	10,782,964	**466,120**	828,450
Canada	**1,712,009**	1,276,763	—	—
West Germany	**606,100**	498,044	**200**	—
United Kingdom	**1,612,540**	—	—	—
Northern Rhodesia	**530,000**	—	—	—
Norway	**593,383**	407,255	—	—
Price per lb	**$2.00**	$2.60-$2.35	**$1.43**	$1.96-$1.78

THE 7-YEAR UPTREND in Free World production of cobalt was reversed in 1957. Production is estimated at 15,500 short tons compared with 16,000 tons in 1956.

U.S. imports in the first nine months were 11% more than during the corresponding period of 1956. Receipts of metal from Belgium and Belgian Congo were down 16%, but those from Canada, West Germany and Norway were up 93, 87, and 71%, respectively. Noteworthy was the receipt of 1,613,000 and 530,000 lb of metal from the United Kingdom and Federation of Rhodesia and Nyasaland, the metal was acquired in exchange for surplus agricultural commodities. Imports of oxide from Belgium and white alloy from Belgian Congo declined 25- and 49%, respectively.

U. S. Supply. Production of cobalt metal for nine months was 1% less than in the corresponding period of 1956 but imports were up 22%. Production of oxide increased 10% but imports declined 25%. Production and shipments of salts and driers during the first nine months are shown in the table.

(Co content in pounds)

	1957 9 months	% change
Production:		
Salts	**220,918**	−17
Driers	**474,078**	+12
Hydrate	**119,839**	−33
Shipments:		
Salts	**230,195**	−15
Driers	**469,432**	+13
Hydrate	**126,120**	−11

Consumption was 7,204,000 lb during the first nine months compared with 7,281,000 lb in the corresponding period of 1956. Cobalt-chromium-tungsten-molybdenum alloys represented 35% of total consumption and the quantity used was 2% more than in 1956. Magnet alloys took 31% (up 5%).

Concentrate producers from domestic ore were Bethlehem Cornwall Corp., Calera Mining Co., and National Lead Co. Production (cobalt content) was 3,430,000 lb during the first 10 months, compared with 2,886,000 lb in the corresponding period of 1956.

Garfield (Utah) refinery of Calera Mining Co. produced 10% less cobalt metal in the first 10 months of 1957 than in the corresponding period of 1956. An electrolytic refining unit was added to the plant in late 1957. It will produce a higher grade product at lower cost and eliminate the hydrogen reduction and arc furnacing steps formerly used.

National Lead Co.'s refinery at Fredericktown, Mo., produced 49% more cobalt metal in the first 10 months of 1957 than in the corresponding period 1956, and output of the refinery of Pyrites Co. at Wilmington, Del., was up 14%.

African Metals Corp.'s refinery at Niagara Falls, N. Y., operated at a substantially lower rate and discontinued refining activities the latter part of 1957. Cobalt products formerly supplied from the Niagara Falls plant will hereafter be shipped to customers from the company refineries in Belgium and Belgian Congo. Construction of the new refinery of Metallurgical Resources, Inc., Newburgh, N. Y., neared completion.

Production of cobalt by International Nickel Co. of Canada, Ltd, Port Colborne, Ont., Falconbridge Nickel Mines, Ltd., Kristiansand, Norway, and Rhokana Corp., Nkana, Northern Rhodesia, was larger then in 1956, but outputs by Union Miniere du Haut-Katanga, Belgian Congo, and La Societe Miniere de Bou-Azzer et du Graara, French Morocco, were smaller. There was no cobalt metal production at the refinery of Sherritt Gordon Mines, Ltd., Fort Saskatchewan, Alberta, from April through August of 1957, as the cobalt circuit was used as a pilot plant. A new and improved cobalt leaching circuit was being installed. The new circuit will make the old one available for pilot plant work without interfering with cobalt production. Some cobalt matte produced by Chibuluma Mines, Ltd., Ndola, Northern Rhodesia, was refined to metal in Europe on a toll basis.

The price of metal and oxide was reduced 35c a lb Feb. 1. This reduction followed one of 25c on Dec. 1, 1956.

Outlook. Free World production of cobalt is expected to continue at a high rate in 1958, again assuring adequate supplies for industry and stockpiling•

FERROALLOY METALS

Molybdenum

Wilmer McInnis
U.S. Bureau of Mines

INCREASED domestic production was from the large Climax mine in Colorado, which is the principal Free World source of molybdenum, and from copper operations in Arizona, New Mexico, Nevada and Utah, and from a tungsten operation in California where the molybdenum was recovered as a by-product. Output of 44.7-million lb during the first nine months of 1957 was 3% higher than the quantity produced during the same months of the previous year. Production from the Climax mine was up 10% and comprised over two-thirds of the domestic output. By-product recovery of molybdenum from copper operations was off 11%, but that recovered as a by-product of tungsten was up 34%, compared with the first nine months of 1956.

Climax Molybdenum Co. completed the addition of another 3,000 to 4,000 tpd unit to its mill at Climax in February that increased over-all milling capacity to about 36,000 tpd of ore. Termination of a contract in October between the Federal Government and Climax Molybdenum Co. that had required the company to mine and mill a minimum of 5,000 tpd of sub-grade ore also permitted an increase in molybdenum output from the mine.

Foreign. Free World production in 1957 is estimated at 4.5-million lb of molybdenum. Chile continued to be the major foreign producing country, and output of 1.3-million lb in the first half of the year was 10% more than the quantity produced in the first six month of 1956. All output in Chile was recovered by the Braden Copper Co. from its copper operations near Sewell. Anaconda Co. constructed a molybdenum recovery unit at its Chuquicamata copper property. Operation of the unit is expected to start early in 1958. Small molybdenum mines operated in Canada, Japan and Norway were the principal sources of the remaining output.

U.S. Molybdenum Statistics

(Thousands of lb of contained Mo)

	1957 estimated	1956
Concentrate:		
Production	**60,000**	57,462
Consumption	**31,000**	42,652
Exports[1]	**19,000**	17,981
Primary products[2]:		
Production	**30,500**	41,208
Shipments: (total)	**32,600**	42,820
Domestic	**30,400**	39,082
Export	**2,200**	3,738
Consumption	**30,500**	33,497

[1]Includes roasted concentrate.
[2]Comprises ferromolybdenum, molybdic oxide, and other compounds and metal.

Consumption of molybdenum in concentrate during the first nine months of 1957 totalled 26.9-million lb compared with 31.4-million lb in the same months of 1956. The decrease was due largely to a strike at the Climax Molybdenum Co.'s conversion plant at Langeloth, Pa., from July to November, which resulted in a short supply of molybdic oxide for use in the production of other molybdenum products and for direct addition to alloy melts. As a consequence, industry stocks of molybdenum concentrate reached a three-year high in August while producers' stocks of primary products dwindled to the lowest level since 1950.

Molybdenum is used predominantly in iron and steel alloys to which it is added principally in the forms of molybdic oxide and ferromolybdenum. Of the 23.6-million lb reported consumed during the first nine months of 1957 in the U.S., 75% was used in high speed and other alloy steels, 10% in alloy cast iron and steel mill rolls, 6% in high-temperature and corrosion-resistant alloys, 3% as metal, and 6% in catalysts, pigments, lubricants and miscellaneous applications.

Prices of molybdenum products remained constant throughout 1957. Molybdenite concentrate containing 90-95% MoS_2 was quoted at $1.18 per lb of contained molybdenum plus cost of container f. o. b. Climax, Colo., and $1.23 at Washington, Pa.; ferromolybdenum, 55-75%, $1.68 per lb contained molybdenum, and molybdic oxide in bags $1.38 per lb contained molybdenum, f. o. b. Langeloth, and Washington, Pa.

Exports of molybdenum contained in concentrate (including roasted concentrate) during the first nine months of 1957 totalled 16.3-million lb compared with 12.4-million lb during the same months of 1956. Major importing countries were: West Germany 23%, Japan 21%, United Kingdom 20%, Sweden 10%. Nine other countries combined received 26% of the total. Exports of ferromolybdenum for the same months totalled 364,000 lb. There were no imports of molybdenum concentrate reported during the first nine months.

Outlook for molybdenum in 1958 is that production will be ample to meet both domestic and foreign needs. Exports are expected to increase and domestic consumption will follow steel production. Expanded uses in high-temperature alloys, catalysts and fertilizers are not expected to change the ratio consumed in ferrous alloys significantly•

Vanadium

George E. Drake
Electro Metallurgical Co.

TOTAL DOMESTIC consumption in 1957 was down slightly from the 4-million lb used in 1956. The decline was primarily in ferrovanadium, the form of the metal used in the manufacture of tool steels, engineering steels, high-strength structural steels, non-aging rimming steels and special wear-resistant cast irons. This drop reflects the decline in steel production in 1957, although other forms of vanadium were about the same or slightly above 1956 levels.

With a considerable amount of vanadium consumed as ferrovanadium by the steel industry, the predicted decline in steel production for 1958 will be an important factor in determining total vanadium consumption. Ferrovanadium accounts for more than 75% of all vanadium consumed in the U. S. However, renewed research and

development with vanadium as an alloying agent in both ferrous and nonferrous metals, stimulated by increased availability, as well as the new vanadium chemical uses should make 1958 an active year for this metal.

In 1957, vanadium consumed as vanadium oxide was about the same as the 1956 figure of 258,350 lb. Ammonium metavanadate consumption showed an increase above the 168,460 lb of contained vanadium used in 1956, and vanadium in all other forms decreased from the 1956 consumption level of 485,700 lb. All figures are those of the Bureau of Mines, and final figures for 1957 have not been compiled at this time.

Vanadium, an important alloying element first added to steel in 1896, has been used mainly for its grain refining and alloying effects. In tool steels, vanadium produces stronger and tougher tools with the ability to hold better cutting edges. In spring steel and other engineering steels, vanadium increases resistance to fatigue failure which results from repeated reversals of stress.

Vanadium is also used in the production of permanent magnet alloys, and titanium-base alloys in which it improves high-temperature strength. One important high-strength titanium alloy contains 6% aluminum and 4% vanadium.

Vanadium oxide and ammonium metavanadate are basic raw materials used in the manufacture of vanadium catalysts. The catalysts in turn have important applications in many chemical oxidation processes such as in the production of sulphuric acid and phthalic and maleic anhydrides. These basic raw materials are also used in the production of colored glazes for porcelain enamel and ceramic ware, and as driers or color fixatives in paints, dyes and inks. Vanadium oxide finds additional applications in the production of tool steel, nonferrous alloys, and pure vanadium metal.

Outlook. Pure, ductile vanadium metal has many potential applications that could result in a considerable increase in vanadium consumption in the near future. Since production of pure vanadium metal was started by Electromet in 1949, sales have increased sharply.

The largest potential use for vanadium metal is in the atomic energy program. In atomic power reactors, vanadium could replace zirconium for fuel cladding as operating temperatures of the reactors are increased to improve thermal efficiency. An application that is still in the experimental stage is a family of vanadium-base alloys for aircraft airframes. Electronic applications for vanadium include use as cathodes for x-rays, getters and resistors•

Chromium

Wilmer McInnis
U.S. Bureau of Mines

U.S. CONSUMPTION in 1957 continued an upward trend that has persisted since 1954. Industry supply was obtained from foreign sources while the small domestic output was sold to the Government at incentive prices.

Domestic production (shipments) of chromite during the first nine months of 1957 totalled 120,000 short tons, the same as in the first three quarters of 1956. Lumpy ore and fines comprised only 7% of the total quantity shipped and only 20% of the concentrate met Government purchase program specifications; the remainder was sold to the Government under terms of an individual contract. All shipments were from mines and mills in Alaska, California, Montana and Oregon. About 75% of the total output was from the Mouat mine in Montana, where ore was beneficiated to a concentrate grading 38.5% Cr_2O_3 and sold to the Government under a long-term contract, and 21% was from mines and mills in California. Kenai Chrome Co. had produced over 9,000 tons from its Star Four mine in Alaska but made no shipments during the first three quarters of the year. Sourdough Mining Co. of Seldovia, Alaska, made a small shipment of high-grade chromite to the Grants Pass depot in September.

U.S. Chromite Statistics

(Thousands of short tons)

	1957 estimate	1956
Production	**160**	162
Imports	**2,000**	2,175
Consumption (total)	**1,750**	1,847
Metallurgical	**1,175**	1,212
Refractory	**425**	475
Chemical	**150**	160

U.S. consumption during the first nine months of 1957 totalled 1,353,000 short tons, a slight increase over consumption during the same months of 1956. The metallurgical industry consumed 886,000 tons that averaged 47% Cr_2O_3 in the production of 375,000 short tons of chromium alloys and chromium metal containing 233,000 tons of chromium.

The industry used an additional 19,000 tons (49% Cr_2O_3) for direct addition to steel. Of the total chromite consumed in producing the alloys and metal, 749,000 tons were metallurgical grade ore and concentrate that averaged 48.1% Cr_2O_3, 90,000 tons chemical grade 44.3% Cr_2O_3, and 47,000 tons refractory grade 34.4% Cr_2O_3. Seventy-one per cent of the metallurgical grade ore had a Cr/Fe ratio of at least 3:1. Chromite consumed in the production of refractories and in furnace repairs totalled 339,000 tons (34.7% Cr_2O_3), compared with 345,000 tons during the same months of 1956, and the chemical industry used 109,000 tons 44.8% Cr_2O_3) in the production of 79,000 tons of chromium chemicals.

High- and low-carbon ferrochromium together comprised 81.9% of the total alloys and metal produced, ferrochromium-silicon 13.8% and exothermic chromium alloys, chromium metal and miscellaneous chromium alloys combined comprised 4.3% of the total.

Consumption of chromium alloys and metal during the first nine months of 1957 totalled 195,000 short tons, compared with 208,000 tons during the same months of 1956. Of this tonnage 64% was used in the production of stainless steel, 30% in other steel, 4% in high temperature alloys and 2% in cast iron and other uses. High- and low-carbon ferrochromium comprised 22% and 48%, respectively, of the total consumed.

Stocks of chromite at consumers' plants at the end of September totalled 1,537,000 short tons that averaged 41.9% Cr_2O_3, compared with 1,194,000 tons that averaged 42.1% Cr_2O_3 at the end of September 1956. Producers' stocks of chromium alloys and metal were 65,000 tons, compared

(*Continued on p 167*)

Nonmetallics

Charles F. Talbot
Production Manager
Magnet Cove Barium Corp.

"Of 2-million tons domestic barite output in 1957, about 75% went into drill fluid preparation."

Robert B. McDougal
Commodity Specialist
U.S. Bureau of Mines

"Acid-grade fluorspar output should increase in '58 . . . metallurgical might . . . ceramic—little change."

Tabor de Polo
Commodity Specialist
U.S. Bureau of Mines

"Feldspar use in dinnerware and pottery . . . fell off . . . due to increased use of nepheline syenite."

Milford L. Skow
Commodity Specialist
U.S. Bureau of Mines

" . . . GSA offered new five year incentive-type contracts on foreign mica production for stockpiling."

Nelson C. White
Vice President, Potash Div.,
International Minerals & Chemical Corp.

"Average increase of about 5% in potash for fertilizer is expected by most experts in next few years."

Langbourne M. Williams
President
Freeport Sulphur Co.

"Total new sulphur capacity including those not completed [U.S.] is estimated at 275,000 annual tons."

C. V. O. Hughes
Assistant Department Manager
Virginia-Carolina Chemical Corp.

"Eight Florida mining companies produced 75% of domestic phosphate—about 33% of world output."

Walter A. Rukeyser
Consulting Engineer
Montreal, Quebec

"Three new Thetford mills will be completed in 1958, raising milling capacity by 25% over 1957."

William S. Steele
President
American Vermiculite Corp.

" . . . About 23,000 tons of vermiculite were used in 1957 . . . considerable increase expected in 1958."

Vermiculite

William S. Steele
American Vermiculite Corp.

IN SPITE OF the expected shrinkage in construction usage, the vermiculite industry maintained its production levels in 1957, although net profits were somewhat less than in 1956.

Increases in the use of vermiculite as a carrier in pesticides; filler in fertilizers; home insulation in air-conditioned structures; and for industrial uses such as pre-formed blocks, slabs, tile, etc.; plastics for fireproofing and acoustical treatment have offset to a large extent the reduction in other structural uses.

In addition, a strong trend has been developing towards the combination of vermiculite aggregates with other lightweight aggregates such as expanded shale, slag, perlite, pumice, etc. Conventional vermiculite concrete blocks for partitions, spandrel back-ups and similar non-load bearing uses, are now being produced with densities below 10 lb per 4x8x18-in. block.

Extruded vermiculite composition billets are being produced 36x18x9-in. in dimension. Tile, brick, blocks and slabs are then sawed to precision dimensions for insulating and acoustical products within the temperature range minus zero to 1800 deg F.

The Vermiculite Association (affiliated with Mandoval Research Committee, London, and Transvaal Ore Co. Research, Johannesburg) and the Vermiculite Institute have all contributed important developments to the industry.

ASTM Specification C35-57T has reduced the minimum weight requirement for vermiculite plaster aggregate from 7½ lb to 6 lb per cubic foot, as a result of Vermiculite Association activities. Underwriters' Laboratories, in column fire tests conducted for Vermiculite Association, has confirmed this reduction when applicable to fireproofing with vermiculite-gypsum plaster.

Tests by Vermiculite Institute are resulting in a new concept for the fireproofing of steel floors with vermiculite acoustical plastic, and Mandoval has developed the acceptance of vermiculite plaster as a fireproofing for concrete floors in the United Kingdom.

Minerals, Inc. and Southern Vermiculite Co. both located at Franklin, N. C., and Patterson Vermiculite Co. of Enoree, S. C., are now producing exfoliated vermiculite from local properties.

Costs of domestic vermiculite ores have remained stable throughout the year except for some increases in railroad freight rates. South African vermiculite ore increased slightly in June 1957, but retained its competitive position vis-a-vis domestic ore at coastal points. A reduction in ocean freight rates effective Jan. 1, 1958, has partially offset the increase in ore cost, however.

In the absence of complete 1957 figures, it is estimated that approximately 230,000 tons of vermiculite were consumed in 1957. A survey of vermiculite-gypsum plaster jobs, installed during the past 26 years, failed to develop a single instance of delayed chemical reaction or volume expansion in the field.

Pit and Quarry lists 62 vermiculite exfoliating plants in the U. S. in 1957 not including plants which exfoliate vermiculite solely for their own use and not for resale.

A considerable increase in vermiculite use is expected during the year 1958. Production capacities at the mines in South Africa, Montana, and the Carolinas; as well as plant exfoliating and fabricating facilities; are adequate to handle a 33⅓% increase in volume through their distributing centers in every state in the United States, in Canada, and in the Caribbean and Central America.

Fluorspar

Robert D. McDougal
U.S. Bureau of Mines

CONSUMPTION increased to a new record in 1957, while over-all domestic production was about equal to that of the previous year. Domestic producers met keen competition from the importers in the commercial market and consequently Government purchases were a factor in maintaining domestic output.

Domestic acid-grade fluorspar production totalled approximately 188,000 short tons and shipments about 192,000 tons with an estimated value of $10.7-million. Imports of acid-grade fluorspar for consumption substantially exceeded domestic shipments.

During the year there were several important changes in the industry; the Kaiser Aluminum & Chemical Corp. closed its mine near Gabbs, Nev., early in the year due to ore depletion, and its mill at Fallon was placed on standby status in September. Quo Vadis Mines, Inc., purchased the Bell Hill Mining Co's. fluorspar property in Jaub County, Utah, and was reported to have built a flotation mill at Delta to upgrade the local ore to acid grade. Mid-November saw a change in the operational status of two Illinois producers, the Mackey-Humm Fluorspar Mining Co. and Hicks Creek Mining Co., were reportedly purchased by H. Evans Roberts, partner in the Montana operation, who plans to construct a flotation mill for acid-grade fluorspar.

Output of domestic ceramic-grade fluorspar declined slightly from the previous year. Domestic metallurgical-grade fluorspar dropped to about 111,000 tons or approximately 23% below 1956.

Illinois, as in 1956, was the leading producing state in 1957 supplying approximately 52% of the total. Over-all production in Kentucky increased slightly, but there was a decline in output of metallurgical and ceramic grade material. Several small mining operations were reported to have been undertaken. An increase in the production of finished fluorspar, practically all acid grade, in Colorado was noted over the previous year. Fluorspar production (all metallurgical grade) in Montana and Utah was about equal to the 1956 output, while there was a drop in Nevada production due to the closing of the Kaiser mill at Fallon.

Fluorspar imports for consumption, partly destined for the Government stockpiles, were expected to reach

nearly 630,000 short tons of which approximately 420,000 tons was acid grade. Imports of acid grade exceeded the domestic shipments by about 119% and metallurgical grade imports surpassed domestic shipments by almost 89%.

Prices, which began to improve during the summer and fall of 1956, remained fairly stable throughout 1957. Trade journal quotations of Mexican fluorspar prices indicated that they declined slightly during the year. European fluorspar prices were quoted at near domestic prices in 1957.

A new record for consumption probably was reached in 1957. Fluorspar consumed in the production of hydrofluoric acid (used to manufacture aluminum fluoride and synthetic cryolite—vital raw materials in the aluminum industry; as a major source of fluorine for the chemical industry; and as a catalyst in the production of high octane aviation fuels) increased to 320,000 tons compared with 289,500 tons in 1956. In addition some acid-grade fluorspar was consumed in the glass and enamel, and aluminum- and magnesium-reduction industries. Approximately 40,000 tons of ceramic grade material was consumed in glass and enamel plants and in other applications such as fluxes.

Consumption at steel plants was about 268,000 tons compared with 264,400 tons in 1956 and it was estimated that for the first nine months of 1957, 4.3 lb fluorspar were consumed to produce one long ton of basic open-hearth steel. An average of 5.4 lb fluorspar was consumed per long ton of basic open-hearth steel produced in 1956 and 4.9 lb in 1955. Iron foundries may consume about 15,000 tons and 1,000 tons in glass and enamel plants.

Fluorspar Statistics

(Short tons)

	1957 estimated		1956
	U. S. production	Total shipments	
Acid grade	188,000	**192,000**	167,500
Ceramic grade	22,000	**21,000**	23,000
Metallurgical grade	107,000	**111,000**	139,200
Total	317,000	**324,000**	329,700
Imports:*			
Containing more than 97% CaF_2		**420,000**	251,000
Containing not more than 97% CaF_2		**210,000**	234,500
Total		**630,000**	485,500

U. S. Consumption:**	Acid	Ceramic	Metallurgical	Total	
Hydrofluoric acid	320,000	—	—	**320,000**	289,500
Glass and enamel	4,000	30,000	1,000	**35,000**	36,300
Steel	—	—	268,000	**268,000**	264,400
Iron foundry	—	—	15,000	**15,000**	13,700
Other	4,000	10,000	7,000	**21,000**	17,500
Total	328,000	40,000	291,000	**659,000**	621,400

*Includes Government purchases. **Excludes Government purchases.

Outlook—Acid-grade fluorspar requirements should increase during 1958 if projected expansion plans in the aluminum and chemical industries materialize. Metallurgical-grade fluorspar might increase if the steel plants operate at a higher level than in 1957. Ceramic-grade fluorspar consumption has remained relatively stable the last few years and little change is anticipated in the next year•

Feldspar

Taber de Polo
U.S. Bureau of Mines

BASED on preliminary estimates for 1957, the domestic feldspar production will closely approximate the high figure attained in 1956. Most producers report production for sanitary ware, tile, and pottery feldspar down 20 percent or more, but feldspar for the glass industry held up well, principally because of substantial increases in glass-container production.

After a long shutdown, the Trenton, N. J., grinding plant of Golding-Keen Co. was reopened early in December to produce pottery-grade feldspar from material shipped in by boat from Canada. The raw material is mined by an affiliated company, Spar-Mica Corp., Ltd., of Canada, from the Cape Feldspar mine at Baie Johan Beetz. Ore is crushed and concentrated by high intensity magnetic separators and electrostatic machines by a method recently (1956) patented as the Diamond process. The company has used process at Keene, N.H.

Lawson-United Feldspar and Minerals Co. opened its new plant at Minpro, N. C., in July. Plant is equipped to produce 8,000 tpm of glass-grade feldspar in addition to other grades of feldspar, scrap mica, and glass sand, all from alaskite ore. In 1957, only a limited quantity of 200-mesh glass feldspar was produced.

Consumption by the dinnerware and pottery industry fell off appreciably due to increased use of nepheline syenite and increased competition from imports of foreign pottery, notably from Japan and Germany. Three or four dinnerware companies closed during the year, and more may be forced to close.

Other companies have followed the lead of Del Monte Properties, Calif., and are recovering feldspar from sands in California and Kansas.

One of the large companies cut prices in glass-grade feldspar, from $12.50 to $10 per ton, f. o. b. producer's plant, and in nepheline syenite from $13.50 to $12 per ton.

International Minerals & Chemical Corp. showed increased production in the first full year of operation of its new nepheline syenite plant at Blue Mountain, Ont., Canada. With two producing companies, more potteries are using nepheline syenite.

Nepheline syenite (ground) imports from Canada continued to increase. For the first seven months of 1957 imports were 30 percent higher than for the equivalent period in 1956.

Production of aplite, another substitute for feldspar, increased approximately 17 percent in 1957 over 1956•

Gypsum

Leonard P. Larson
U.S. Bureau of Mines

INDUSTRY ACTIVITY during 1957 was lower than in the preceding 12 months primarily as a result of the lower rate of residential construction. The decline in residential construction can be shown by comparing data for the first eight months; starts totalled 700,500 units, 7% below 1956 and the lowest for any like period since 1949. Coupled with this decline and partially offsetting it was the 10% increase in public construction, primarily in the construction of state and locally owned projects such as schools, highways, sewers and water facilities.

Estimated crude production during 1957 is nearly 9-million short tons—about 13% below the output in 1956. Output for the first three months of 1957 was 23% below 1956—1,987,125 short tons as against 2,590,884 tons. During the second and third quarters, output of crude gypsum rose steadily and consequently during the third quarter production exceeded the corresponding period of the previous year by 12,156 tons. Output for the first three quarters thus averaged 13% less than in the same period of 1956.

U.S. imports of crude gypsum during the first nine months of the year declined 3% from the 1956 figure. Of the 3,238,557 short tons imported, 2,818,200 tons or 87% was supplied by Canada, 9% by Mexico, and the remaining 4% by Jamaica and Dominican Republic. Imports from all sources supplied the nation with 32% of its domestic requirements, an increase of 3% over the previous year. Whereas domestic production of crude gypsum declined by 13%, imports declined by only 3%.

The gypsum industry which is estimated to have a rated capacity of 1.3-million housing units a year continued to expand its production facilities during 1957. These projects and their products include: Kaiser Gypsum Co.'s expansion of its wallboard and plaster plant at Antioch, Calif.; Arizona Gypsum Corp.'s new raw products plant at Winkelman, Ariz.; National Gypsum Co.'s new processing plant at Burlington, N. J. The company also continues construction and development work at its mines at Tawas, Mich., and in Nova Scotia•

Potash

Nelson C. White
International Minerals & Chemical Corp.

U.S. PRODUCTION in 1957 followed the pattern of the past by exceeding all previous years. Preliminary estimates indicate the output at about 3.9-million tons of products containing approximately 2.3-million tons K_2O. The increase in K_2O tonnage was nearly 6% above 1956.

Shipments to North American consumers were also increased over last year. American Potash Institute figures for the first nine months show an increase of 5% over the same period in 1956. The rate of increase fell off in the last quarter and the total change for the year is estimated at between 3% and 4%. Although the bulk of these shipments were made by U.S. producers, materials were also imported from France, Germany, Spain and, for the first time, Russia. Import tonnage is estimated at about 220,000 tons K_2O, an increase of about 7% over last year. Imports supplied about 10% of the North American market.

As an offset to the effect of increased imports on domestic producers, there was a substantial increase in exports from the U.S. of about 30% over 1956. Approximately 215,000 tons of K_2O were delivered abroad, mostly to Japan and other Far Eastern countries. Exports to markets outside North America accounted, therefore, for about 10% of the shipments made by the domestic industry.

Total shipments to domestic and foreign buyers were approximately 2,210,000 tons K_2O, an increase of over 5% above 1956. With production up 6%, the difference went into inventory and the industry enters the new year well stocked for the expected heavy demand in the January to May fertilizer season.

The continued trend to more seasonal buying of potash for agricultural use, which accounts for 95% of the total market, and continued demand by some fertilizer manufacturers for a coarser product than the standard material produced, led to a change in price structure, the first significant change in over four years. During May, June and July, price schedules on muriate, which accounts for 93% of the potash market, were introduced by various individual companies differing from last year's schedules and from each other. The differences included a seasonal pricing system with lower prices on shipments in the slack summer season, and a differential in price between standard and coarse forms of product. Stability was reached by mid-summer at a level approximately 3% below last year.

The long-term outlook, both at home and abroad, is for a continuing increase in potash use. Increasing populations, higher living standards and diminishing areas of lands suitable for agriculture are forcing more intensive farming. The natural mineral content of soil is soon depleted and replacement is necessary. An average increase of about 5% per year in potash for fertilizer is expected by most experts. Industrial use will also grow slowly but remain relatively unimportant.

Production will also continue to increase and supplies sufficient for all demands will be the rule for the foreseeable future. Domestic producers already have capacity in excess of domestic purchases and three new properties, one in Carlsbad and two in Canada, should be in operation within three years. In addition, continuing exploration is being carried out near Moab, Utah, and the area near Unity, Sask., recently forfeited to the government, has been reclaimed. Since each new mine usually has an initial capacity approximating 200,000 tons of K_2O, it seems reasonable to predict that no shortage is likely. However, although the domestic producers have been active in foreign markets for the last three years, they have not yet obtained the position abroad they must eventually

reach. Furthermore, some of the new production, particularly that in Canada, may well displace existing capacity rather than add to it. These two factors can offset to a substantial degree the apparent excess of supply over demand and maintain the ratio within sound limits.

Plant changes during the year by the eight domestic producers were largely confined to two areas, improving efficiencies and providing more coarse muriate to meet increased demands for this product.

United States Borax & Chemical Corp. completed mining facilities in a new mining area at its Shaft No. 3, six miles north of the main shaft. Ore will be mined exclusively by the use of continuous miners and extensible belts. After being hoisted at this shaft, the ore will be transported in 50-ton diesel trucks to the present railroad for shipment to the refinery near Loving, N. M. During the year a $2.5-million construction program was completed at this refinery for increased production of high-grade coarse muriate of potash of various sizes.

Potash Company of America, during 1957, completed a transition to exclusive use of continuous mining machines at its Carlsbad mine. Coarse muriate of potash production was increased by substantial additions in the refinery; a flotation unit was completed in August and compactors, which compress fine muriate crystals into hard flakes for subsequent crushing and sizing, were put into operation in September. The company's Saskatchewan potash project, 14 miles east of Saskatoon, made substantial progress. Construction of the surface plant was begun in June and shaft-sinking operations continued through the year, reaching a depth of 2400 ft by year end. Project is scheduled for completion late in 1958.

International Minerals & Chemical Corp. began shaft-sinking operations near Esterhazy, Sask., in May. By the end of the year, preliminary freezing of water-bearing strata had been completed and the shaft had been sunk through the glacial till. At Carlsbad, underground operations were improved by the installation of several rope belt conveyors on the 850-ft langbeinite level, by conversion of various auxiliary mining vehicles to diesel power for the sake of maneuverability and speed, and by improved gathering haulage on the 900-ft sylvinite level with track-type car movers. A new screening and sizing plant was installed in the refinery to increase the production of coarse muriate, and the 18-mile water line to the refinery was completely cleaned and plastic-coated.

Duval Sulphur & Potash Co. constructed a compaction plant during the year to increase its production of coarse muriate of potash. Fine fractions are compacted into hard thin flakes in this plant for subsequent crushing and screening to coarse muriate.

Southwest Potash Co. also installed a compaction plant to increase its coarse muriate production late in the year. In its mine, the company obtained substantial tonnages of ore by extraction of pillars in secondary mining operations.

National Potash Co. completed the construction of its mine and refinery in January and started refining operations on Jan. 30. During the year production has been at 50% to 66% of designed capacity. Construction of additional facilities for the production of coarse muriate has been started. During the year the company increased its reserves by the purchase of a Federal reserve from Department of Interior for $1,867,340.

American Potash & Chemical Co. doubled its production of coarse muriate of potash at its Trona, Calif., plant during the year. The company's investment in these facilities was approximately $750,000. Screening equipment to produce a more uniform coarse muriate of potash was also installed as part of the company's $3.5 million improvement program in 1957.

Bonneville, Ltd. continued regular operations at its solar evaporation and flotation plant at Wendover, Utah.

Farm Chemical Resources Development Corp. completed its first shaft during 1957. The refinery is being designed on the basis of ore obtained from this shaft, and the mine and refinery are not scheduled for completion until late 1960. This company is a joint venture of National Farmers Union, Kerr-McGee Oil Industries, Inc., and Phillips Petroleum Co.

Phosphate

C. V. O. Hughes
Virginia-Carolina Chemical Corp.

WORLD PHOSPHATE rock production probably rose slightly above 34-million long tons of salable rock.

U.S. 1957 production was about 15.6-million long tons. The U.S. continued to be the world's leading producer, accounting for about 45% of the world total. Value of U.S. phosphate rock production at the mines was probably over $90-million.

Africa retained second place with about 9-million long tons; of this, 8-million tons comes from French Morocco, Tunisia and Algeria. Russia's production now exceeds 5-million long tons, over 90% of all European phosphate rock produced.

Western Pacific (Oceania) production amounted to nearly 2-million tons. Most of this is from British possessions or dominions.

Asia accounted for about 1-million long tons; and South America for about a half-million long tons.

U. S. production comes almost entirely from three fields: Florida, the Western states and Tennessee. Florida produced about 11.5-million long tons; the Western states about 2.4-million; Tennessee about 1.7-million long tons of rock.

Florida. Eight mining companies produce three-quarters of all U.S. phosphate rock (or one-third of the world total). American Agricultural Chemical operates two mines: Boyette and South Pierce. They report few changes in 1957. A new 20 cubic yd dragline is on order; they now operate one 18 cubic yd dragline and four 9-yd draglines.

American Cyanamid continues to operate its Sidney mine; they shut down the Saddle Creek operation in January 1957, and opened the new Orange Park mine in April 1957. They operate four draglines, all with 17 or 18 cubic yd buckets. Cyanamid also put its new 200,000 tons-per-year triple superphosphate plant into operation in May 1957 at Brewster.

Armour maintained its operations unchanged in 1957. Bartow mine worked a five-day week throughout the year.

Coronet Phosphate Division (Smith-Douglass) also operated its Tenoroc plant without major change. The 150-ft hydroseparator was replaced with a bank of seven 24-in. Dorrclones. At the defluorinating plant, production of potassium silicofluoxide was increased.

Davison Chemical Division (W. R. Grace) moved their 17-yd dragline from the Bonnie mine to the Pauway mine. They are pumping raw matrix 4½ miles from pit to washer at Pauway.

International Minerals & Chemicals worked both a 21 cubic yd and a 30-yd dragline at Noralyn all year. The Noralyn washer capacity was enlarged; also, cyclones were placed in parallel with the 175-ft hydroseparator to increase desliming capacity. The Achan mine, with 17-yd dragline, operated on a five-day week throughout the year. At Prairie Junction (processing center), new truckloading facilities were installed.

Swift & Co. operated its Watson and Varn mines essentially unchanged. A new 14-yd dragline is under construction and will go into operation in 1958.

Virginia-Carolina Chemical continued to operate its Homeland and Clear Springs mines. Dragline operations were temporarily suspended in late July, but both flotation plants continued to operate on accumulated feed. In October, the Homeland flotation plant operation was increased to a 7-day week; the Phosmico flotation plant was shut down.

North of the main Florida field, small operations in "hard" rock and "soft" (colloidal) rock will probably produce about 150,000 tons total in 1957.

Western States. Production of 2.4-million long tons is mostly from Idaho and Montana, with smaller tonnages from Wyoming and Utah.

Anaconda continued surface mining at its Conda mine near Soda Springs, Idaho. Mining takes place in summer; ore beneficiation is year-round. Production goes mainly to the fertilizer plant at Anaconda, Mont.

Central Farmers Fertilizer Co. is building an electric furnace and fertilizer plant near Georgetown, Idaho. Owned by midwestern cooperatives, the company intends to produce fertilizers, mainly calcium metaphosphate.

Monsanto Chemical continued open pit mining at its Ballard mine, near Soda Springs, Idaho. Ore is processed in electric furnaces at Soda Springs.

Montana Phosphate Products mined all year near Garrison, Mont. This is largely underground; an 11,000 ft crosscut is being driven to provide tunnel entry and eliminate shaft hoisting.

San Francisco Chemical operated its Leefe mine in Wyoming, its Arikaree and Cherokee mines in Utah, and its Waterloo mine in Idaho. A new wet beneficiation plant was placed in operation at the Leefe mine. Company is conducting extensive prospecting near Vernal, Utah, on the Humphrey phosphate deposits.

J. R. Simplot operated its Centennial open pit on the Idaho-Montana border, and Gay mine near Pocatello, Idaho. All of the Centennial mine output is shipped to Canada. Gay mine's production goes to Pocatello, partly to Westvaco's electric furnaces and partly to Simplot's fertilizer plant.

J. A. Terteling & Sons prospected on Federal phosphate leases in southeastern Idaho. Huskey Oil Co. prospected in the same area.

Victor Chemical continued underground mining at the Maiden Rock and Canyon Creek mines near Silver Bow, Mont. Ore is shipped to Silver Bow for washing, and is then fed to Victor's two electric furnaces in Silver Bow.

Tennessee. In Tennessee, most of the phosphate rock goes to electric furnaces owned by Monsanto, Victor, and Shea Chemical. Monsanto and Victor contract their mining and beneficiate and nodulize the rock for furnace feed. Shea Chemical purchases all its furnace feed.

TVA ships about 70,000 long tons of matrix to its electric furnaces at Florence, Ala.

Armour and Virginia-Carolina Chemical operate mines and washers. Armour's production goes into superphosphate. V-C makes some superphosphate, ships ground rock, and supplies nodulized rock for electric furnace feed.

Ruhm, Boyle and Highland production all goes into ground rock for direct application to the soil.

Tennessee deposits are in general small and irregular. The field's production has been static at 1.5- to 1.7-million long tons per year for 10 years. Since the rock produced is low grade, nearly 80% goes into electric furnaces to produce elemental phosphorus. Over 20% goes into agricultural uses, mainly for superphosphate or as ground rock for direct application to the soil.

Western rock is not significantly higher grade than Tennessee rock. Over 60% of Western rock goes into electric furnaces; about 20% goes into agricultural uses (mostly into triple superphosphate); about 15% is exported. Western deposits are large, and will increase in importance.

Florida rock is much higher grade than either Tennessee rock or Western rock. Only 7% of Florida rock goes into domestic electric furnaces; between 20% and 25% of Florida rock is exported; about 50% goes into superphosphate; 15% goes into triple superphosphate; and the remainder goes into ground rock for direct application to the soil, or into animal feed.

During 1957, Kennecott Copper's Bear Creek subsidiary carried on extensive exploration on North Carolina phosphates. There appears to be a large deposit in North Carolina, but mostly of low grade and under relatively deep cover. Exploration is continuing. The future of this potential phosphate field cannot be accurately assessed at present•

Mica

Milford L. Skow
U.S. Bureau of Mines

FABRICATION of block and film mica in 1957 decreased about 15% compared with 1956, reflecting the lower level of industrial activity and increasing substitution of ceramic materials for non-strategic sheet mica in electrical heating appliances. About 60% of the block and film went into electronic applications. Electrical insulation, principally molding plate and segment plate, used slightly less muscovite splittings and about 25% less phlogopite splittings. Production of mica paper reconstituted from natural mica scrap continued to increase moderately.

Sales of ground mica were near the level for 1956, when 91,000 short tons were reported. Dry-ground mica accounted for about 85% of the total

and wet-ground accounted for the remaining 15%.

Imports of block and film were about 20% lower than in 1956. An increase in total imports of splittings resulted from the Commodity Credit Corporation's program of bartering agricultural commodities for strategic materials. India and Brazil continued to supply most of the muscovite sheet mica, and Madagascar furnished virtually all of the phlogopite.

In May, the Government through GSA invited offers on new five-year, incentive-type contracts for the delivery to the strategic stockpile of mica from foreign sources. These contracts would permit the importer to deliver up to one pound of Heavy Stained ruby block mica for each pound of Stained A/B or better qualities meeting stockpile specifications. As of Nov. 30, several contracts were being negotiated.

Domestic production of muscovite ruby and nonruby block, film, and hand-cobbed mica for sale through the Government purchase program continued at a high level. From mid-1952 to the end of 1957 purchasing depots had accepted the equivalent of approximately 12,800 short tons of hand-cobbed mica which is slightly more than half of the total quota of 25,000 tons. No changes were made in the purchase regulations during 1957.

Mica Statistics

(Thousands of lb)

	1957 estimated	1956
Imports:		
Block:		
India	1,900	2,032
Brazil	1,370	2,039
Other	79	138
Total	3,349	4,209
Film:		
India	150	236
Other	1	1
Total	151	237
Splittings:		
Muscovite	8,500	6,946
Phlogopite	600	719
Total	9,100	7,665
Consumption:		
Muscovite block and film:		
Good Stained or better quality	155	181
Stained quality	1,570	1,811
Lower than Stained quality	1,575	1,818
Total	3,300	3,810
Splittings:		
Muscovite	7,800	7,996
Phlogopite	500	666
Total	8,300	8,662

During the first 10 months of 1957 DMEA furnished financial assistance in exploration for strategic mica on 50 active projects, 22 of which were new contracts executed during the period. The 281 contracts executed since the program began in 1951 have resulted in 61 certificates of discovery. On Oct. 31, 1957, 16 contracts still were in force.

Synthetic mica continued to be produced commercially, principally for use in glass-bonded mica ceramics. Strategic grades and qualities of block and film natural mica still cannot be displaced by synthetic mica in its present state of development.

On the 5-year program certified by ODM for development and evaluation of substitutes for strategic natural mica, a total of seven contracts were in force by the end of 1957 on the development of a reconstituted synthetic mica sheet for use in electronic applications. Contracts were signed during the year with Synthetic Mica Corp., Caldwell, N. J.; Arthur D. Little, Inc., Cambridge, Mass.; Battelle Memorial Institute, Columbus, Ohio; Sylvania Electric Products, Inc., Bayside, N.Y.; and General Electric Co., Pittsfield, Mass. Already in force at the start of 1957 were contracts with the Federal Bureau of Mines, Norris, Tenn. and Frankford Arsenal, Philadelphia, Pa•

Asbestos

W. A. Rukeyser
Consulting Engineer

FOR THE PAST three years this review has pointed-up that Canadian production facilities had been already expanded to such degree that output of chrysotile in Canada must perforce be geared to actual sales. Statistics for 1957 appear to emphasize this condition. For the third consecutive year Canadian fiber production and sales balanced within a few thousand tons of each other, hovering at just above the million ton mark. Similarly, throughout the rest of the world—including Russia—production of all varieties seems to have reached what is at least a temporary plateau. However, the most serious expansion of production facilities is scheduled for fruition in the present year. Its probable effects will be discussed later.

For the first ten months of 1957, as reported by the Dominion Bureau of Statistics, shipments from all of Canada totalled 902,127 tons as compared to 842,507 for the preceding year. However, the increase of just under 60,000 tons was almost entirely accounted for by abnormally high sales in September: 135,692 tons against 81,953 for 1956. For, at the end of August, 1957 shipments were 677,444 tons whereas in the year before the similar period showed 669,634, an increase of only just over 1%. And this despite the fact that a severe dip in production of shorts in 1956 had been necessitated because of shutdowns in the U.S. floor tile industry.

The momentary spurt in fiber sales in Canada in September was in all probability entirely due to anticipation of the 5% price increase in all grades which had been noticed effective Oct. 1; and the very fact that the industry could supply the unprecedented volume of 135,692 tons in that month accentuated the point made in the lead paragraph of this review.

The new prices as posted by the Asbestos Corp are:

Standard grade	Minimum tests	Short tons $
No. 1 Crude	.....	1,480
No. 2 Crude	.....	798
3D Fibre	10.5-3.9-1.3-0.3	640
3F Fibre	7.0-7.0-1.5-0.5	593
3K Fibre	4.0-7.0-4.0-1.0	504
3R Fibre	2.0-8.0-4.0-2.0	428
3T Fibre	1.0-9.0-4.0-2.0	402
3Z Fibre	0.0-8.0-6.0-2.0	370
4D Fibre	0.0-7.0-6.0-3.0	218
4K Fibre	0.0-4.0-9.0-3.0	200
4M Fibre	0.0-4.0-8.0-4.0	200
4T Fibre	0.0-2.0-10.0-4.0	203
4T Fibre	0.0-2.0-10.0-4.0	181
5D Fibre	0.0-0.5-10.5-5.0	142
5K Fibre	0.0-0.0-12.0-4.0	142
5M Fibre	0.0-0.0-11.0-5.0	134
5R Fibre	0.0-0.0-10.0-6.0	120
6D Fibre	0.0-0.0-7.0-9.0	86
7D Fibre	0.0-0.0-5.0-11.0	75
7F Fibre	0.0-0.0-4.0-12.0	71
7H Fibre	0.0-0.0-3.0-13.0	61
7K Fibre	0.0-0.0-2.0-14.0	50
7M Fibre	0.0-0.0-1.0-15.0	45
7M Fibre	0.0-0.0-1.0-15.0	44
7R Fibre	0.0-0.0-0.0-16.0	44
7R Fibre	0.0-0.0-0.0-16.0	43
7T Fibre	0.0-0.0-0.0-16.0	41
7RF floats	No test	44
7TF floats	No test	44
8S floats	No test	38
8S floats	No test	27

Note: All prices are in Canadian dollars, per ton of 2,000 lbs. f.o.b. cars, mines, in carload quantities, and subject to change without notice. On carload lots, a freight allowance will be made where appli-

cable. On less than carload shipments, freight allowance will not apply, and there will be an additional charge of $4 per ton.

In addition to the across the line increase of 5% in prices the industry in Canada is for the first time insisting on payment in Canadian funds or their equivalent. Hence the actual increase as at the end of 1957 actually came to about 7%.

The price-profit squeeze causing the rise thus had nothing to do with any question of supply relative to demand as can be seen by reference to "Canadian Asbestos Mining Costs" in the accompanying table. For the latest available figures, 1956, direct costs had increased in every category resulting in a total of about $61-million as opposed to $54.2-million for the year before. The respective fiber production for the two years in question was 1,064,010 and 1,043,051 tons.

It would seem, however, that a goodly portion of the increase in costs was due to the steadily increasing ratio of dead rock which has had to be mined year by year to produce a disproportionate increase in mill feed. For example, whereas in 1952 13-million tons mined produced 10.9-million tons of mill feed—in 1956 21.9-million tons, an increase of almost 8-million tons mined, resulted in only 13.7-million to the mills, an increase of less than 3-million. In the three years 1954-1956 the tonnage mined was up over 50% with a resultant increase in mill feed of only about 20%. Further to stress this trend: 4.3-million tons more were mined in 1956 as compared to the preceding year with only a 1.3-million ton increase to the mills, and with the same fiber output (just over 1-million tons in each case).

An analysis of the breakdown of the Canadian production by groups shows little of the unexpected. Estimates for the full year 1957 based on 10-months actual figures (and remembering that the excess between Quebec and all-Canada statistics represents 3-Group and 4-Group fiber in its entirety) show that the only two groups of fiber which are steadily, if slowly, expanding in volume comprise the asbestos-cement group-4 and the floor tile group-7. All other categories stand at almost exactly the same as the year before or some 3 to 4% less. Hence the writer's index, using the year 1938 as 100, shows a U.S. Gross Product up from the preceding year of 458 to 483. The crudes and milled fibers (through and including group-5) stand about the same as the previous year, 258 vs 256, while the index factor for the shorts have again practically attained that of the peak year, 1955 (540): 538 for 1957. In 1956, when the tile industry was struck for part of the time, the figure was 499. It also appears from the analysis of the figures that the disproportionately slight improvement in the index factor for the milled groups of fibers is due to the production of those grades from British Columbia and Ontario at the expense of the Quebec miners.

Canadian Shipments And U. S. Gross Product

(12-month period, short tons—Quebec, Ontario, B. C.)

	1957 estimated	1956	1955	1948	1938
Crudes	625	717	724	977	2,911
Spinning, shingle, paper	396,000	392,983	395,820	241,953	163,097
Shorts, etc.	664,000	620,549	667,982	473,839	123,785
Total all grades shipped	1,060,000	1,014,249	1,063,802	716,969	289,793
Produced	1,070,000	1,043,051	1,064,010	—	—
Value (shipped)	$100,000,000	$99,859,969	$96,191,317	$42,231,475	$12,890,195
Av. fiber price per ton	$100	$98.50	$90.40	$58.90	$44.40

	1957 estimated	1956	1955	1948	1938
U. S gross product (billions)	$435	$412	$385	$225	$ 90
1938 = 100					
U. S. product	483	458	428	250	100
Spinning, shingle, paper	258	25›	210+	150−	100
Shorts, etc.	538	499+	540+	380+	100

Canadian Asbestos Exports

(Short tons)

	9 months		September	
	1957	1956	1957	1956
Crude	417	420	117	122
Milled fibers	274,082	271,079	36,945	30,841
Waste, refuse, shorts	477,093	435,728	62,147	49,629
Total	751,592	707,227	99,209	80,592

Prepared in the mineral statistics section, industry and merchandising division, Dominion of Canada, Bureau of Statistics, Ottawa.

Canadian Asbestos Shipments by Grades

(Including any for own use—short tons)

	10 months		October	
	1957	1956	1957	1956
Quebec				
Crude: No. 1, No. 2, other	528	552	44	63
Milled: Group 3, spinning	23,274	22,821	2,047	2,601
Group 4, shingle	190,412	168,368	19,467	17,506
Group 5, paper	88,271	91,422	7,787	10,583
Group 6, stucco	136,201	141,219	14,346	13,004
Group 7, refuse	397,868	358,881	39,775	40,636
Group 8, sand	20,815	20,130	1,186	2,450
Total all grades	857,369	803,393	84,652	86,843
Total Canada	902,127	842,507	88,991	90,920

Canadian Asbestos Mining Costs

(Except plant replacement, renewal, expansion, ore depletion)

	1956	1955	1954
Labor and employees	$30,411,878	$28,116,049	$24,850,100
Fuel and electricity	5,541,309	5,117,137	4,130,806
Supplies and containers	12,335,772	11,180,264	9,924,166
Taxes (all)	11,674,042	9,240,496	9,184,997
Workmen's compensation	504,664	392,692	406,147
Silicosis and unemployment insurance	515,481	184,824	184,923
Total	$60,983,146	$54,231,462	$48,681,139
Tons mined	21,922,874	17,696,357	14,394,571
Tons milled	13,740,326	12,427,002	11,394,571
Gross profit	$42,321,163	$45,409,636	$37,728,073
Profits per ton milled	$3.09	$3.65	$3.31
Profit to sales	42%	45%	44%

For the first ten months of 1957 the output from Cassiar (B.C.) and Johns-Manville (Ont.) was approximately 45,000 tons, up some 6,000 tons for the same period of 1956. The estimated total for the year from these two provinces is say, 50- to 55,000 tons. Of this amount J-M's output during the year just past is believed to have been reduced slightly from preceding years to a reported 1800 tons monthly (all of one grade—4Y). Cassiar therefore appears to be producing better than 30,000 tons annually of 3rd and 4th group asbestos fibers.

Developments in 1957—Quebec. Two items made major province news. Johns-Manville at Asbestos virtually completed equipping its new mill—the largest in the world—bringing its rock capacity to a reported 20,000 tpd capable of producing well over two-thirds of the entire Canadian output and with the company's other production, some 40% of the estimated world output. On the other hand, Asbestos Corp. closed its Beaver mill for a complete modernization and an increase in capacity to 5,000 tpd ore. In the interim the old King mill—built in the mid-twenties—will be pushed to whatever extent market requirements dictate. Upon completion of the improvements to Beaver the King will be scrapped so that the corporation's ultimate (as now projected) milling capacity in its then three plants will be about the same as before.

Developments at the newly opened deposits of Lake Asbestos (Asarco), National Gypsum and Carey Asbestos proceeded on schedule with all three new plants coming into full production by mid-1958. Nothing of news has been reported at Chibougamau Asbestos; and the various prospects explored during the previous year continued work; but in many cases on a greatly reduced basis. A new find some 17 miles northeast of the town of Chibougamau has been prospected by Bouzan Mines and New Jason. The property is said to show considerable potential with 8.03% content and a $17.09 place-value per ton.

Ontario. This province's only producer, Johns-Manville Munroe Mine near Matheson has actively pursued its underground development in anticipation of ultimately abandoning open-pit operations. However, the mill is now reported as operating only on a five day a week basis and production is reported down to 1,800 tons monthly. Company's new insulating board plant at North Bay was officially started in September.

British Columbia. Cassiar continues to be Western Canada's only producer and an increasingly important one at that. Company profits are reported at more than had been anticipated. The mill averaged 1,000 tpd feed, a rate which it is planned will be maintained resulting in a life expectancy for the mine of 18 years. Any increase in Cassiar's gross tonnage will in all probability come from three other properties. In September it optioned from its affiliate, Conwest Exploration, three properties in northern British Columbia and the Yukon Territory. The most promising of these is situated at Clinton Creek, 40 miles west of Dawson. The fiber is low in iron and the tonnage potential is reputedly great, outcropping as the deposit does over an area 400x2400 ft.

Newfoundland. Developments at Advocate Mines indicate a semi-harsh fast draining chrysotile orebody of major proportions. Official estimates of presently developed reserves state 27,825,000 tons are in sight, sufficient for a life span of 21 years at the proposed rate of exploitation—containing 1,970,000 tons of fiber with a gross value of $227,500,000. Place-value of the ore is given as $8.15 per ton at 7.1% asbestos content. Initial milling rate, as and when financing is secured, is envisioned at 2,000 tpd, with all costs excepting depreciation and interest estimated at $3.53 per ton of rock mined. By lowering estimates of ore reserves to 23-million tons a millhead of $10.00 can be achieved. Capital requirements are reported at $10-millions for the 2,000 tpd rate. Should the property reach production at the initially proposed rate an additional 40 to 45,000 tons of group-4 (and below) fiber will enter the Canadian marketing picture.

United States production has been declining year by year from some 51,645 tons in 1951 to an estimated 40- to 42,000 in 1957. The reduction is accounted for almost entirely by the dwindling demand for the special characteristics of the Arizona chrysotile. By far the bulk of the output comes from the one operation of Ruberoid Co. in Vermont.

Rhodesia & Union of South Africa output of chrysotile and other varieties appears to be fairly well stabilized at an annual rate of approximately 10,000 tons per month in Rhodesia; and in South Africa the "Cape Blue," amosite and other asbestos production seems to have reached a plateau of 11- to 12,000 tpm.

Venezuela. The president of Amveco, S. A. (an affiliate of World Commerce Corp. of New York) by personal communication estimated his company's production (Amveco is Venezuela's sole producer) at 10- to 12,000 tons during 1957. The fiber is especially acceptable to the asbestos-cement products trade.

Australia is experiencing increased acceptance of its Blue and chrysotile varieties and production has been increased in 1957 to a reported 10,000 tons per year.

Elsewhere in the world, production figures, as far as available for the year just ended, show little if any change from the preceding one. World estimates are in the neighborhood of 1.8- to 1.9-million tons but the figure of 240,000 tons for Russia used in compiling world figures for many years past appears to this writer to be considerably on the low side in view of known exports from the USSR.

Outlook. Three important new projects in the Thetford district of Quebec will be completed this year with the result that three new mills will enter production probably before mid-year. The largest of these, Asarco's Lake Asbestos at Black Lake, will commence full scale output from its 5,000-ton mill. The $35-million project calls for an annual output of over 100,000 tons of fiber, mostly in the "milled fiber" classifications.

National Gypsum also plans early 1958 production from its 3,000 ton mill northeast of Thetford with the 200- to 250 tpd fiber to be used by the company's manufacturing facilities in the U.S. National Gypsum is at present procuring its supply on the open market. The new Carey Canadian Mines Ltd. plant at East Broughton will commence turning out fiber from rock having an inordinately high asbestos content, but mostly of the shorter grades. Finally, although Johns-Manville's newly completed mill is now capable of taking 20,000 tpd feed, the mine is said to be producing only at a rate of some 13,500 tpd. In other words J-M's production potential will be some 50% higher than previously.

With these factors in mind the writer has estimated the Quebec mill-rate potential for the second half of the year (allowing for the renovation shutdown of the Beaver mill of Asbestos Corp.) at approximately 60,000 tpd of ore.

This represents an increase of 25% over 1957 mill capacity. Allowing for the grades of ore at each property, this 25% increase in Quebec mill

facilities should be able to produce over 300,000 tons of new fiber annually—or about 30% more than the present sales rate of all Canada. Furthermore, the bulk of this new fiber will in all probability not be in the "shorts" classification (which accounts for about two-thirds of the total Canadian tonnage shipped annually) but will greatly augment the already over-sensitive "long" fiber market. Yet 1957 closed with Johnson already down to a five-day a week schedule and the year-end announcement from Asbestos Corp. that it has laid off 100 miners for an indefinite period and reduced the work-week of 1,500 others to five days. The decision affects three mines out of a total of four now operating. The company went on to say that it had decided "not to accumulate heavy reserves because of an uncertain 1958 asbestos market."

So in the months ahead, forgetting such future possible operations as those contemplated for Newfoundland, Canada's asbestos industry is coming face to face with a production potential of over 1.3-million tons of fiber annually to compete for its share of the world market which for the past three years seems to have become pretty well stabilized at just about 1-million tons. And that during the time of a world economic boom which now seems to have passed the peak of its ten year energy. It is indeed a buyers' market in asbestos•

Barite

C. F. Talbot
Magnet Cove Barium Corp.

IN THE YEAR 1957, estimated world production for 1957 was approximately 3-million tons. Russia and various other Communist countries are not accounted for.

U. S. Production by areas is estimated to be: (short tons)

Arkansas	450,000
Missouri	380,000
North Carolina, Tennessee, Georgia	150,000
Nevada, Idaho, California, Montana	200,000
Arizona, New Mexico	20,000

The development of new large domestic deposits was limited, while imports rose from an estimated 500,000 tons to 730,000 tons.

Of the approximately 2-million tons produced and imported into the U.S., about 75% was processed into weighting material for drilling fluids. A portion of the imported barite was processed and exported to the Middle East and Venezuela.

World Barite Production

(Thousands of short tons)

	1957 estimated
United States	1,200
Mexico	490
Canada	250
Germany	200
Peru	150
Greece	130
Yugoslavia	70
Italy	30
Cuba	30
Spain	15
Brazil	15

There was no large increase in the use of barite for chemicals, rubber and glass; the tonnage consumed being about 300,000 tons.

Shielding for atomic reactors and heavy aggregate for gas pipeline coating consumed an increasing amount of barite. Atomic requirements should not be large in tonnage, but pipeline aggregate could assume large tonnage proportions in offshore gathering lines.

Inventories of barite, both crude and milled, increased substantially during the last half of 1957, and account in part for the discrepancies that may be found in the above production and consumption figures.

A number of new producers appeared in the barite industry during 1957, and new deposits, both of high grade and those requiring beneficiation, were opened.

Prospecting for barite deposits is continuing, and the shifting logistics occasioned by foreign oil production possibilities make a complicated pattern in a highly competitive industry.

Drilling forecasts do not indicate an increase in domestic drilling, which is the principal user of barite•

Sulphur

Langbourne M. Williams
Freeport Sulphur Co.

INCREASED COMPETITION among producers for sulphur markets was a highlight of 1957. At the same time, the demand for sulphur, a traditional barometer of industrial activity, declined slightly although remaining near the record high established in 1956.

Total consumption of sulphur in all forms in the U. S. was down a few percentage points from the record 5,780,000 tons consumed in 1956. Estimates near the end of the year indicated a 5% reduction but later figures put the decline between 3- and 4%. The lower use of sulphur reflected the leveling off of business experienced by such major consuming industries as fertilizer, chemicals, steel, paper, pigments and rayon.

Most of the sulphur consumed by the nation was mined by the Frasch hot water process from deposits in Louisiana and Texas with a considerable amount imported from Mexico and the remainder obtained in various forms from other sources.

Demand from abroad for U. S. sulphur remained high, indicating that the trend in foreign markets toward brimstone as a source is continuing. It is estimated that exports, all Frasch sulphur, were near the 1956 record high of 1,650,000 tons. Canada, England and France remained the largest purchasers, while Australia, formerly in fourth position, was displaced by India.

Total output of sulphur from all U. S. sources amounted to an esti-

New U.S. Sulphur Recovery Projects Completed or Under Construction During 1957

(Capacity in long tons)

New Facilities:	Estimated annual capacity	Gas source
Allied Chemical & Dye Corp., Bayway, N. J	21,000	Refinery
American Oil Co., Yorktown, Va.	17,500	Refinery
Anlin Co. of New Jersey, Perth Amboy, N. J.	12,250	Refinery
Barnhart Hydrocarbon Co., Reagan County, Tex.	3,500	Natural
Olin Mathieson Chemical Corp., Beaumont, Tex.	24,500	Refinery
Pan American Petroleum Corp., Cottonwood Creek, Wyo.	7,000	Natural
Pontiac Eastern Corp., Hattiesburg, Miss.	8,750	Refinery
Tidewater Oil Co., Delaware City, Del.	119,000	Refinery
Total	213,500	

Expanded facilities:	Estimated annual capacity increase	
Consolidated Chemical Ind., Baytown, Tex.	35,000	Refinery
Gulf Oil Corp., Port Arthur, Tex.	21,000	Refinery
Wilshire Oil Co., Norwalk, Calif.	5,250	Refinery
Total	61,250	

mated 6.9-million tons, compared with 7,820,000 tons in 1956. Of this, Frasch sulphur alone accounted for 5.5-million tons, down from the 1956 high of 6,425,000 tons. As shown in the accompanying table, recovered elemental sulphur, the primary source of which is sour natural gas, registered a small gain.

Eleven U. S. Frasch process mines were in operation throughout the year, and a twelfth, the Damon property of Standard Sulphur Co. in Texas, operated until April, when it was shut down. Texas Gulf Sulphur Co. remained the largest producer, followed by Freeport, Jefferson Lake Sulphur Co., and Duval Sulphur & Potash Co.

In September, Texas Gulf Sulphur announced a sulphur price reduction to meet general competitive conditions. Mexican producers had been offering sulphur at substantially under the U. S. scale. The Texas Gulf announcement was followed by similar action by other U. S. producers. After the reduction of $3 per ton, somewhat over 10%, prices of U. S. Frasch sulphur were quoted at $25 a ton f.o.b. port, for bright sulphur and $24 a ton for the dark product. Trade publications subsequently published reductions in price quotations for Mexican sulphur but later in the year announced an increase in Mexican sulphur prices to $24 a ton f.o.b. port, for the filtered product and $23 a ton for unfiltered.

U.S. Sulphur Production

(Thousands of long tons)

	1957	1956
Frasch sulphur	5,500	6,425
Other elemental		
Recovered	525	465
Other native	50	60
Sulphur in pyrites	425	430
Sulphur in gases	400	440
	6,900	7,820

1957—Freeport Sulphur Co. estimates; 1956—Bureau of Mines.

Three new U. S. salt dome deposits are under development. The largest is Freeport's Grand Isle, a discovery of major magnitude located off the Louisiana coast in 45 ft of water six miles from the nearest land. Grand Isle will be the first completely offshore sulphur mine and will incorporate many unique features designed to make it one of the industry's most efficient operations. The other deposits are Texas Gulf's Fannett dome in Texas and Freeport's Lake Pelto dome in Louisiana.

Eight new plants to obtain sulphur from sources other than salt dome deposits were completed or were under construction during the year, and productive capacity of three existing facilities was being expanded. As shown in the accompanying table, the total new productive capacity of these projects, including those not yet completed, is estimated at about 275,000 tons annually.

There were sulphur developments also elsewhere in the Free World, particularly in Mexico, Canada and France.

The first company to produce sulphur in Mexico, Mexican Gulf Sulphur Co., ceased production at its San Cristobal mine in May after three years of operation. The Export-Import Bank, which had loaned Mexican Gulf $5-million to enable it to get started, is now in the process of liquidating the company.

Production of Frasch sulphur in Mexico approached 1-million tons compared with 750,000 tons in 1956. Two mines operated during the entire year—the Jaltipan property of Pan American Sulphur Co., the major producer, and the Amezquite property of Gulf Sulphur Co. A subsidiary of Texas Gulf Sulphur began production in February at Nopalapa, although no shipments were reported by year end.

In Canada, several new projects were completed or were nearing completion for the recovery of sulphur from sour natural gas or refinery gases. The companies involved and the estimated annual capacities are Laurentide Chemical & Sulphur Co., Montreal East, Quebec, 35,000 tons from refinery gases; British American Oil Co., Pincher Creek, Alberta, 78,750 tons from natural gas; and Jefferson Lake Sulphur Co., Taylor Flats, B.C., 100,000 tons from natural gas.

In France, the start of production of elemental sulphur from the Lacq gas field was announced by the Societe Nationale d'Aquitaine. A unit went on stream in April at an annual productive capacity of 60,000 tons.

TITANIUM (*Continued from p. 126*)

and failure by the fabricator to keep various alloys separate.

The biggest problem is, of all things, familiarity. Production workers, and many engineers, too, are afraid of titanium. Yet, interviews with people who have worked with the metal in machining, fabrication and testing show that fear almost groundless. Aircraft workers at Boeing showed no reluctance to work with titanium and scoff at the idea that it is hard to work. And, the most telling fact of all concerns the jet engine J-57, which used a titanium instead of stainless steel compressor.

At the beginning of the program,

the cost of the engine with the 40% lighter compressor was from $90- to $100,000 greater. By mid-summer of 1957, that cost differential was reduced to $30,000 greater. As fabricators learn more about the metal, rejects are fewer. With such cost reductions come newer markets and a better competitive position.

Outlook for titanium is not bright for early 1958, unless Congress reinstitutes the B-52 program. An *E&MJ* poll of producers and industry authorities of the likely date for a strong titanium industry based on "peacetime" uses has brought a range of answers. The consensus seems to place it at 10 years, more or less—one producer sees no expansion needed for the next four to six years. But with the fabulous history of the metal, all agree that anything can happen. One expert is saving an article from the financial press which was unfavorable to titanium and its future. "I'm saving it," he says, "because someday someone is going to have to eat it"•

ZINC (*Continued from p. 136*)

to be at a low ebb. Unfilled orders on producers' books of 18,217 tons were at the lowest year-end figure in twenty years. The hoped-for tariff increase which might have stemmed the flow of world excess production to U.S. markets had not materialized and imports were at a peak. The London market, discounting an increase in the tariff, was selling at the lowest levels since the Exchange reopened after the War, and foreign zinc could be bought at levels that would permit the buyer to ship to the U.S., pay the current duty and undersell the U.S. market by 1c a lb.

There were some favorable factors in the situation which should be taken into consideration in appraising the current year. In the first place, curtailment at the mine level already in effect here and abroad will ultimately have its impact on the supply of metal when the lag between mine production and smelter output has been taken up and liquidation of excess concentrate stocks at smelters has been completed. Second, it is probable that the industry will receive increased tariff protection by the end of the first quarter or early in the second, either upon the recommendation of the Tariff Commission or Congressional action, or both, which will discourage the dumping of world surplus supplies in this market. In the third place, there has recently been some relaxation in the restrictions which terminated the barter program and there is renewed interest in trading for zinc. It is quite possible that this could be the instrument by which foreign metal surpluses could be absorbed until the supply-demand picture is in better balance. However, offsetting any resumption of bartering on a large scale is the possibility that the Government's strategic stockpiling which has been continuing at the rate of 10,000 tons per month, will be terminated when tariff relief is granted, if not before. Fourth and most importantly, there should be a pickup in demand during the first half. The steel industry, with which the use of zinc is closely allied, was operating at a low for the year of between 55% and 60% of capacity. The steel industry has forecast a pickup during the second quarter of 1958. In summation, while the year has started on a poor note, enough favorable factors are developing to expect a stabilization and firming of the market by mid-year with any material improvement in price coming in the second half as general industrial activity of the economy warrants it•

CHROMIUM (*Continued from p. 155*)

with 38,000 tons in the same month of the previous year.

Prices quoted for all grades of foreign chromite softened during the year, except for chemical-grade ore from the Union of South Africa which was quoted at about $3 a ton higher at the end of November. Prices quoted f.o.b. Eastern seaports at the end of November were: Turkish, 48% Cr_2O_3, 3:1 Cr/Fe ratio $55-57, off $4; Rhodesian, 48% Cr_2O_3, 3:1 Cr/Fe ratio $51-53, off $4.75; and South African (Transvaal), 44% Cr_2O_3, no ratio $30-30.50, up $3.25.

Research in 1957 was conducted by both Government and industry. The U.S. Bureau of Mines continued its work toward improved methods for the beneficiation and utilization of subgrade domestic chromites. Geological Survey reappraised domestic reserves and concluded that they comprised about 3.5-million tons of Cr_2O_3, mostly in low-grade deposits. Armour Research Foundation continued its research on the mechanical properties of unalloyed chromium and Massachusetts Institute of Technology made studies on chromium and its alloys

Imports of chromite during the first nine months of 1957 totalled 1,554,000 long tons, up 8% from the previous year. Sixty-three per cent of the total was metallurgical grade ore and concentrate, of which Federation of Rhodesia & Nyasaland supplied 39%, Turkey 30%, Union of South Africa 19%, and seven countries combined supplied 12% of the total. Refractory grade ore was largely (73%) from the Philippines, and all chemical grade ore was from the Union of South Africa.

World production of chromite in 1957 was over 4-million short tons. The large stockpile of ore accumulated at mines in Rhodesia was reported to have been virtually eliminated during the year: Rhodesian Railways transported record tonnages during the first quarter. Newly discovered chromite deposits in the Belingwe Reserve, near the Marques Railway in Rhodesia, were said to cover an area of about 15 square miles. Turkish producers were reported to have been producing at a rate of 1- to 1.5-million tons. The chrome committee in that country was reported to have fixed export prices equivalent to $48U.S. a ton, f.o.b. Turkish port, for mineral containing 48% Cr_2O_3, with a variation in scale of $0.90 to increase or reduce for every percentage, more or less, of the basis content. Production in both the Philippines and the Union of South Africa also continued at a high level.

Outlook for chromium in 1958 is little different from 1957: Domestic production may be expected to continue at about the same level with the entire output going to the Government at above world prices; imports may decrease while industry cuts down its stocks; consumption will continue to follow steel production, and will be relatively unchanged•

Metal and Mineral Processing

James W. Franklin
Associate Editor

Pebble milling progress in Canadian uranium and gold mines, as summarized by Bunting S. Crocker, and S. W. K. Morgan's report on production of zinc in a blast furnace were among the top developments reported outside *E&MJ*. These two, along with late uranium milling advances, are reported here. For regular *E&MJ* coverage of the metal and mineral process industry, see introduction below.

THIS IS ANOTHER regular installment in *E&MJ's* month-to-month attempt to keep you up to date on the latest developments in metal and mineral processing, from primary crushing through refining and secondary smelting.

In addition to the regular issues and the February Review, three issues reviewed current developments in 1957. See *E&MJ Mid-June Mining Guidebook*, pp 82 through 123. See November *E&MJ*, "Stockholm Meeting". Also see p 145, December, a short index of process developments followed by 15 pages of modern flowsheets. For developments in new products, patents, operating ideas and processing as appears in each regular issue, see the annual index published on pp 209 through 228, *E&MJ*, December 1957.

Solvent extraction on metals other than uranium, electrical concentration of dry solids, and both aqueous and gaseous chemical processing will most likely be top developments in 1958.—Colorado Research Foundation is doing basic research on solvent extraction; so is Dow Chemical — Carpco just recently announced a High-Tension Process for iron ore — Dow has a process for producing green salt or the hexafluoride right at the uranium mill — Alan Wood will build an H-Iron direct reduction plant — Eastern Mining & Smelting may build a nickel refinery in Quebec based on the Sherritt Gordon Process —Dry chlorine is being used on lead-zinc concentrate in Germany. We'll hear more about these developments in 1958.

There has been a noticeable increase in the number of mining companies and equipment manufacturers who are using the staff and resources of our privately endowed research foundations — Colorado, Stanford, Ontario, Battelle — to name a few.

In addition to *E&MJ's* coverage, here are some of the important advances reported in industry literature during 1957 — from Toronto to Cape Town.

Pebble Milling—B. S. Crocker Reports

". . . In nine cases out of ten, your own ore can be used more efficiently [than steel balls] and far more economically to do the grinding job."—Bunting S. Crocker, chief metallurgist, Kilborn Engineering, in his paper in the *Norther Miner*, Nov. 28, 1957. Crocker went on to tell how and where he believes pebble milling to be better, cheaper.

Pebbles are used instead of balls at Lake Shore Mines (since 1949), Wright Hargreaves (1950), Bicroft and Faraday Uranium (1956 and 1957), and North Rankin Nickel (1957). He also mentions the Neptune Mine of Asarco in Nicaragua (1956). For Scandinavian developments see *E&MJ*, "Stockholm Meeting," November 1957. Mr. Crocker says that such mills are also in use in South Africa.

Most of the Canadian mills use rod mills to grind the pulp down to 6 or 8 mesh, then finish with pebbles scalped from their own ore at 2¾ x 1½ in. size. In South Africa and Central America, pebbles are hand picked at up to the size of a man's head for grinding minus ⅜ in. feed. In Canada, the pebbles are periodically scalped ahead of the secondary crusher and stored in bins that hold 2 or 3 days production, then automatically fed into the grinding mill with pulp from the classifier.

Crocker described Bicroft and Faraday practice, since these two uranium mills best illustrate a plant originally designed for pebble milling rather than a conversion job. These two 1,000-tpd mills are divided into two 500-tpd circuits, each with a 6x8 ft rod mill drawing 80hp and treating 600 tpd of minus ½ in. secondary crusher discharge.

Rod mills open into a classifier in closed circuit with a 9x11 ft grate-discharge pebble mill drawing 240 to 260hp as needed. Final grind is 55 to 65% minus 200 mesh.

Mill rod consumption is about ½ lb per ton on this friable coarse-grained granite-pegmatite feed.

Mill pebble consumption is about 30 tpd from the rock bin, which means that 3% of the rated tonnage bypasses from the secondary crusher and the rod mill, and is consumed in grinding the remainder of the days feed. During start-up, pebble consumption is usually higher—5% at Bicroft and Faraday.

Pebbles are collected in two or three hours work on each shift, stored in bins holding only two or three days requirements—eliminating a 3 to 6 month storage and inventory of steel balls, a considerable expense which Crocker rates at up to $160 a ton.

Capital cost of a pebble mill is somewhat higher than for a ball mill, but operating costs are lower. Crocker illustrates the possible savings (10 to 38c a ton), using Lake Shore Mine's conversion from ball to pebble mill as an example. Cost savings are as follows on that siliceous gold ore:

Saving	Cents per ton
Steel consumption	28.5
Liner saving	0.5
Bypassing 3% of feed	1.6
Reduction in primary agitation in milling	1.3
Lower tailings	2.8
Finer grind obtained	3.0
Total saving	37.7c

Pebble milling has other advantages, which Crocker lists.

Flexibility—an operator can change his grinding media in two or three days in a pebble mill. It would take up to six weeks to change the ball charge on a steel media, plus the fact that 3 to 6 months of ball inventory must be used up before the operator can make a change. Besides, ball manufacturers charge more for smaller balls. Both of these facts have long discouraged mill men from attempting to make a media size change—even one that they knew would be beneficial. With a pebble charge, a change

can be made anytime by simply changing screens—as long as you're hoisting ore, you're hoisting grinding media.

Versatility—it has long been said that pebble milling can only be applied to hard siliceous ores such as those found at Kirkland Lake, Ont. Mr. Crocker says that almost any ore will produce desirable media—even soft shales. Tests show that shales clean up the "chips" better than hard rock, and do not build up in the charge as some silica ores do. Slabby ores are suitable for minus 8 mesh feed, as pointed out in the article.

Charge control—close shift by shift control is needed, but no more trouble is encountered than on a ball mill. "Tests indicate that a complete cessation of rock feeding for 24 hours will lower the pebble level in the mill only about 4 in."—Roland W. Merwin, mill superintendent, Neptune Gold Mining Co. (Asarco), Nicaragua. All pebbles can be used efficiently; not just the round ones.

Chemical changes occur in pebble mills that do not occur in ball mills. More oxygen is produced since there is less steel surface to take up the oxygen. Crocker says that this is an advantage in gold and uranium leaching but not in flotation. And it might be added that in many copper flotation circuits, oxidation appears to be the cause of 'phantom oxide' losses. Crocker suggests that thorough testing be done in the laboratory before converting to a pebble mill. It is best to study the chemistry of your flowsheet before making up your mind to use a pebble mill instead of a ball mill.

Blast Furnace Zinc—a Dream Come True

What might be considered as the top metallurgical development in the past 25 years was announced by S. W. K. Morgan, Imperial Smelting Corp. Ltd., Avonmouth, England, in *Institute of Mining & Metallurgy Bulletin*, No. 609, August 1957. Imperial Smelting has two blast furnaces in operation, producing 70 tpd zinc.

Commenting on the development in *IMM* No. 613, December 1957, Harry C. Lancaster applauded the Avonmouth engineers, ranking their accomplishment with Bessemer, Thomas, Gilcrist; indeed, another runner-up to the Williams Process for desilverization.

He added that many lead smelters produce a slag containing as much as 23% zinc (Broken Hill), which is discarded on the dump. If the Imperial technique is pursued, Mr. Lancaster expects to see a smelter going after this lost zinc. Widespread use of the Imperial technique by the lead smelters would increase the amount of zinc on the market without opening a single new mine.

Here's how the process works. Charge is a hard sinter-roast of zinc concentrate, with the dust removed to prevent contamination of the zinc collected in the condensers. Furnaces are operated at about 1,100 to 1,300 deg C and top gases, running 5 to 6% zinc and controlled amount of CO_2, are collected.

Shock-cooling the top gases with a shower of molten lead leads to collection and recovery of the zinc. Lead is circulated at 2-ft head in a standard lead pump. About 12,000 tons of lead are circulated for every ton of zinc collected.

The idea of shock cooling is not new, having been used in a research attempt to condense magnesium with hydrogen gas as a coolant many years ago. But the idea of using molten lead — neutral and non-contaminating to the zinc — is an excellent achievement.

Zinc recovery is 89% at Imperial. When the process is used on a lead-zinc concentrate, the lead is recovered as a bullion from the furnace tapout. Imperial has tested some high-copper zinc concentrate in its pilot furnace and is convinced that high-copper concentrate can be treated in the big furnaces. Copper would be recovered in a matte; lead in a bullion; and the zinc in the condensers. Imperial plans to run some full-scale tests in the near future.

Fuel consumption is 104% of zinc collected. Some condenser off gas is used to preheat incoming air to 600 deg C, and incoming charge to 800 deg C. About 25% of the heat energy is excess and is used to heat plant boilers. With a lead-zinc concentrate no extra energy is needed to reduce the lead, since lead oxide reduces exothermically with CO.

Energy consumption is 21,000 Btu per lb of zinc collected, as compared with a reported 27,000 Btu per lb electrolytic zinc recovered at Cerro de Pasco. But the Imperial furnaces use a relatively high-cost fuel — metallurgical coke.

Many attempts have been made in the past to smelt zinc in a blast furnace, but without success. Key to the Imperial Process is proper control of ingredients in the top gases. At proper conditions, as regards CO, CO_2, PbS and PbO concentration, very little zinc is re-oxidized after leaving the reduction zone.

Slags to date have been tolerable as to both lead and zinc content.

Free World Uranium Developments

Thucholite in Rand ores can be floated, first with a frother alone, then with a xanthate, for maximum recovery of 70 to 80% U. However, presence of cyanide in gold mill slimes is detrimental to good flotation results. —J. Levin, *South African Institute of Mining & Metallurgy Journal*, November 1956.

Uranium and pyrite are floated at Vogelstruisbuit, according to F. O. Read and others in *South African Institute of Mining & Metallurgy Journal*, February 1957, from old reef cyanide slimes at 40% U and 90% sulphur recovery. Concentrate is mixed with slime from current cyanidation, then leached for uranium extraction. Finally, the residual pyrite is floated from the uranium-leach tailings.

A revolution took place at Hartebeestfontein Gold Mines in July, according to H. Britten, chief metallurgist for Anglo-Transvaal Corp. After considerable test work, Harties switched the flowsheet from a gold-uranium to a uranium-gold plan. Results to date have been very favorable as to both gold and uranium recovery.

Leaching the uranium first releases the locked gold in the pyrite that the former cyanide operation could not touch. Results show about 50% reduction in tailing losses—from 0.433 dwt/ton to 0.232 dwt/ton. They are also able to recyanide some of the old slime tailings after acid leaching. Uranium recovery does not seem to suffer from the switch—communication with Mr. Britten.

In the U. S., solvent extraction is taking over uranium production. When all the new mills are onstream in 1958, just about half of our production will come from solvent extraction flowsheets•

E&MJ Surveys Mine, Mill, Smelter

As in past years, *E&MJ* surveyed the mining industry's capital investment in the future—in mine, mill, smelter and refinery developments in 1957. We have divided our survey into four categories—projects announced or starting construction; projects still under construction from previous years; projects completed and in production; and expansion programs.

Total capital investment committed or spent in 1957 in these four categories comes to more than $3.53-billion. To arrive at this figure, we counted only those projects where we could report a dollar value.

Projects announced or starting construction in 1957 total 104, with capital value in excess of $1.34-billion. In 1956, our survey reported 42 new projects worth $970-million. Here, in 1957, copper, iron, uranium, nickel and aluminum received the most attention.

Projects still under construction from previous years represent a total of $1.134-billion in 23 projects. In the 1957 list there is one $100-million-plus project each for iron, copper, nickel and aluminum. In 1956, we reported 36 projects worth $670-million.

Projects completed and in production came to 66 in 1957. Their book value is in excess of $727-million. Last year, 32 projects worth $355-million were completed. Here, in 1957, copper, uranium and aluminum lead the parade, with most of the projects to be found in Canada and the U.S.

Announced or completed expansion programs in 1957 cover 30 facilities with $326-million committed or spent. Last year, the number was 29 and the value $230-million.

One important fact about 1957 does not reflect in our annual study—falling metal prices halted many a mine development program, particularly in speculative ventures. Many new copper and lead-zinc producers closed down shortly after going onstream. Many a shaft sinking was halted, due to lack of funds and lack of investor interest at low metal prices. See Copper, pp 114-115.

Watch closely the list of mining's hot spots—101 places in the world where new mines, new ventures may start in the near future. Note that iron and aluminum are getting most of the exploration attention, as was the case last year.

Projects Announced or Starting Construction in 1957

MANGANESE

North Carolina. U.S. Manganese-Sulphate—mine, refinery

Socorro, N. M. Anderson Bros. Corp.—1,000-tpd mill to cost $150,000

Colon, Panama. Exploraciones Rosaria, S. A. to build

French Equatorial Africa. U.S. and French interests will raise $67-million to finance 500,000 annual ton output

British Guiana. African Manganese Co. let contract for $7-million railroad into property due onstream 1960

Woodstock, N. B. Strategic Manganese Corp. plans a 3,000-tpd electro-smelter to produce 70,000 annual tons of 76% ferro-manganese and 74,000 tons of ingot iron

IRON AND STEEL

Conshohocken, Pa. Alan Wood Steel will build $3.6-million, 50-tpd direct reduction facility (H-Iron Process)

Indiana Harbor, Ill. Inland Steel will build a sinter strand (150,-000 annual tons), pushing capacity to 300,000 annual tons.

Pea Ridge, Mo. Bethlehem Steel and St. Joseph Lead Co. (Meramec Mining Co.) will spend $35-million on a mine and 10,000 tpd-concentrator

Stanford, Mont. Montana Iron Ore Co. is opening a 500-tpd open pit

Randville, Mich. M. A. Hanna Co. is erecting a 700,000 annual ton concentrator to cost $11-million. Will go onstream in 1959

Michigan. M. A. Hanna will have an open pit at Mineral Hill mine

Michigan. Homer-Wauseca shaft is being sunk

Ashland, Wis. Ashland Mining Co. to build concentrator with 1.5-million tons of pellets output a year

Minnesota. Oliver Mining is building a washer at Trout Lake; onstream in 1958

Minnesota. M. A. Hanna is stripping Musser mine for 1958 production on the Cuyuna Range

Minnesota. M. A. Hanna's New Pierce open pit is being readied for 1958 production

Minnesota. Mahoning Group is building 750-tph heavy media concentrator and washer

Moose Mountain, Ont. M. A. Hanna is building taconite concentrator due in 1958 with 500,000 annual tons of pellets

Antikokan, Ont. Steep Rock Iron Mines Ltd.—building $2-million sink-float (350 tph) concentrator to treat 750,000 tons a year of low-grade ore

Steep Rock, Ont. Canadian Charlson will build 300,000 annual ton concentrator. Onstream in 1959

Shelter Bay, Que. Cartier Mining is constructing a $300-million taconite project; onstream in 1961 at 3-million tons a year

Kimberly, B. C. Consolidated Mining & Smelting Co. will spend $5-million on an electric furnace pig iron plant

Sibuguey, Philippines. Three Japanese steel firms will join with Philippine interests to develop 1-million ton per year project. Cost—$5-million

Endau, Malaya. Endau Iron Mining Co. Ltd. will open 180,000 annual ton mine. Cost—$93,000

Barsua, India. Hindustan Steel Private Ltd. will develop 6,000-tpd mine. Cost in excess of $5-million

Iron Baron, South Australia. Broken Hill is putting the Iron Baron mine into production

Chihuahua, Mexico. Altos Hornos de Mexico will build a 500-tph heavy media plant and a smelter. Loans for $28-million capital cost have been made

Zelaya, Nicaragua. Metalchime will spend $3-million

Guatemala. Krupp will process beach sand for iron

Chile. Bethlehem Chile to build a 6,000-tpd mill

Chile. Cia. Minera Santa Barbara to build 4,000-tpd mill

Acari, Peru. Panamerican Commodities S. A. is opening 1-million annual ton mine to cost $7-million. Onstream in mid 1958; to expand to 3-million tons within 18 months

El Trueno, Venezuela. Mivenca will spend $52-million to develop 3.5-million annual ton project. Onstream in 1959; expanded to 7-million by 1962

URANIUM

Lakeview, Ore. Lakeview Mining Co. has mill contract for 210-tpd mill to cost $2.6-million

Riverton, Wyo. Fremont Minerals 500-tpd mill to cost $3.5-million

Grants, N. M. Kermac Nuclear Fuels Corp. building 3,300-tpd mill. Cost—$16-million. Onstream in 1958

Grants, N. M. Homestake-Sapin Partners mill to treat 1,500 tpd will cost $10-million. 1958

Grants, N. M. Homestake-New Mexico Partners 750-tpd mill will cost $5.3-million. 1958

Grants, N. M. Phillips Petroleum Co. is building $9.5-million mill to treat 1,700 tpd in 1958.

Rifle, Colo. Union Carbide's new mill (1,000 tpd) will cost $8.5-million; to replace old mill

Metropolis, Ill. General Chemical to build 5,000 annual ton UF_6 plant. Cost—$12-million

Bancroft, Ont. Canadian Dyno Mines hopes to be in production in late 1958. 1,000 tpd. $8-million for mill

Australia. Mary Kathleen mill, being built by Rio Tinto, will cost $20-million

COPPER

Reading, Pa. Metals Refining Co will build $4-million refinery—1,200 tpm output

Anne Arundel County, Md. Kennecott Copper Corp. will build electrolytic refinery, costing $20-million, which will start treating Braden concentrates in 1959 at 7,000 tpm

Encampment, Wyo. Trans-State Mining Co. stripping for open pit, may build 200-tpd upgrader

Illinois. Illinois Zinc Co. will build copper powder refinery for high-purity production

and Refinery Developments in 1957

Twin Buttes, Ariz. Duval Sulphur states that they plan to open pit and mill at 10,000 tpd in late 1959 $20-million
Annacis Island, B. C. Western Copper Mills will erect an $8.5-million fabricator
Chelmsford, Ont. Consolidated Sudbury Basin Mines will spend $15-million on roast-leach plant to treat 620 tpd concentrate. Mill now has 1,500-tpd capacity and will be expanded to 3,000
Chibougamau, Que. Quebec Chibougamau Goldfields plans 1,000 tpd mine and mill, but has stopped work due to low copper price
Northern Rhodesia. Chambishi and Baluba mines will be in production by 1960
Northern Rhodesia. Nchanga is stripping for a second open pit. Production starts in 1958
Chile. Empresa Minera de Mantos Blancos has a $2.2-million loan from International Finance Corp.
Chile. National Smelter Corp. will build a 400-tpd smelter and 36,000 annual ton electrolytic refinery
Peru. Ventures may build a 150-tpd mill at Chavin
Iligan City, Philippines. Samar Mining Co. will build copper refinery and smelter

NICKEL

Chicoutimi, Que. Eastern Mining & Smelting has permit to build $22-million smelter-refinery, based on Sherritt Gordon process. Planned for 1958, but not yet financed
Levack, Ont. International Nickel Co. started construction on $12.5-million Levack mill. Will go onstream in 1958 to treat 6,000 tpd ore
Sudbury, Ont. Nickel Rim Mines plans smelter to go onstream in 1959. Mill capacity is at 1,500 tpd ore
Choate, B. C. Western Nickel Mines Ltd. (50% Newmont) plans 400-tpd mine and mill
Thompson, Manitoba. International Nickel Co. began construction of $175-million hydro, mine, mill and smelter. To go onstream in 1960 at 75-million lb nickel annually. Will raise Inco's production to 385-million lb per year
Guatemala. M. A. Hanna asked for concession; will spend $2-million on mine and mill
New Caledonia. Quebec Metallurgical and French interests will mine and treat laterites

ALUMINUM

Massena, N. Y. Reynolds Metals Co. will erect $88-million reduction works with 200-million lb capacity
British Guiana. Aluminium Ltd. is building 250,000 annual ton alumina plant. Cost will be $33-million. Onstream by 1959
Vigo, Spain. Reduction works planned
Orissa, India. Indo-Canadian Indian Aluminum Co. will erect 10,000 annual ton reduction works. Bauxite and alumina facilities will be expanded
Borneo. Aluminium Ltd. plans 175,000 annual ton bauxite project
Surinam. Aluminum Co. of America will build hydro plant and reduction works at cost of $45-million. 60,000 tons per year

TITANIUM

Wilmington, N. C. Allied Kennecott Titanium will erect a $40-million titanium dioxide refinery, using Quebec I&T titanium. Local source will be sought
Amelia Island, Fla. Union Carbide is building a 500-tph dredge, wet and dry mill to treat beach sand
Oaxaca, Mexico. Minera Tisur plans 1,500-tpd gravity mill
Umgababa, Natal, South Africa. Anglo-American Corp. is developing $4.5-million beach sand project
Veracruz State, Mexico. Industrias Quimicas Basica de Mexico will construct an 8,000 annual ton titanium dioxide refinery. Cost—$6.5-million

LEAD-ZINC

Cockle Creek, NSW, Australia. Consolidated Zinc will erect a smelter to treat Broken Hill ore. Onstream by 1960, it will reach 47,000 annual ton production in 1963
Chancay River, Peru. Cia. Minerales Santander—$1.5-million mine and mill
Sardinia. Electrolytic refinery planned to yield 15,000 tons per year. Cost—$4-million

OTHER METALS

Hawthorne, Nev. Kennametal plans a tungsten carbide plant at their Nevada scheelite project
Indonesia. Tambang Tinah Bangka will build tin smelter
Niagara Falls, N. Y. Olin Mathieson Chemical Corp. will construct $36-million boron rocket fuel plant. Due 1958-1959
Lawrence, Kan. Callery Chemical Co. will build $38 million boron chemical fuels plant
Val d'Or, Que. Quebec Lithium may build lithium chemical refinery. Cost—$3-million

NONMETALS

U. S. W. R. Grace and Pechiney plan to build a 20,000-lb high-purity silicon producer
Georgetown Canyon, Idaho. Central Farmers Fertilizer Co-op will build 1,500 tpd phosphate mine and mill. Cost will be $10-million
Vernal, Utah. Stauffer Chemical started construction for a 2,000 tpd mine and mill to tap 700-million ton phosphate deposit. Elemental phosphorus will be produced. Total cost will be $20-million
Carlsbad, N. M. Farm Chemical Resources Development is sinking a shaft for potash development
Patience Lake, Sask. Potash Co. of America is developing 4,000-tpd mine and mill to go onstream in late 1958. Cost will be $20-million
Esterhazy, Sask. International Minerals and Chemical Corp. is constructing a $20-million mine and mill to go onstream in 1959. Will treat 720,000 tons annually
Houston, Texas. American Sulphur Co. will extract sulphur from the Humble Dome, former oil well
Jefferson County, Texas. Texas Gulf Sulphur Co. is constructing a Frasch sulphur plant
Grand Isle, La. Freeport Sulphur will set up a Frasch sulphur plant on Humble property
Tehuantepec, Mexico. Central Minera S. A. is setting up a $3.5-million, 1,000 tpd Frasch sulphur plant
Whiskey Island, Ohio. International Salt Co. will develop salt mine. Cost will be $7.5-million
Clark Station, Nev. Eagle-Picher Co. to erect mill to produce 166 carloads of diatomaceous earth a month
Mykonos, Greece. Magnet Cove Barium Corp. is building a barite mud processing plant
Panamint Springs, Calif. Lawson H. Linde and partner will build $50,000 bentonite clay washer
Bovill, Idaho. J. R. Simplot is constructing a $1-million clay processing plant
New Mexico. Great Lakes Carbon will open the No Agua perlite deposit
Calgary, Alberta. Royalite Oil Co. plans to build a $50-million oil-from-Athabaska-sands refinery
Thetford, Que. Lake Asbestos plans production for late 1958 at 4,000 tpd ore
Thetford, Que. National Asbestos—3,000 tpd onstream in 1958
Thetford, Que. Eastern Asbestos Corp. plans 2,500 tpd mine and mill

These Projects Are Still Under Construction

IRON AND STEEL

Aurora, Minn. Erie Taconite—better than 80% complete. Mill will be onstream in 1958 to treat 20-million tons of taconite a year. Cost will be $300-million for mine, railroad, harbor and mill. Output will be 7.5-million tons of pellets a year
Ottawa, Ont. Hilton mine of Steel Co. of Canada will have 60,000 ton per year pelletizer in 1958
Steep Rock, Ont. Caland Iron Ore Co.—3-million ton a year by 1960
Jamestown, Ont. Algoma Ore Properties is developing the Sir James mine for siderite production at 500,000 tons a year

URANIUM

Maybell, Colo. Trace Elements mill will be completed in 1958. Cost—$2.2-million
Riverton, Wyo. Lucky Mc Uranium Corp. mill will cost $7-million, treat 750 tpd in 1958
Blind River, Ont. Stanrock Uranium—3,000 tpd in early 1958. Cost for mine and mill—$24.5-million
Blind River, Ont. Northspan's Spanish American mine and mill will operate at 2,000 tpd in 1958. Cost for entire Northspan Project (Nordic Lake, Spanish American and Panel Cons.)—$75-million
Blind River, Ont. Northspan's Panel Cons. will start producing in 1958 at 3,000 tpd

Blind River, Ont. Milliken Lakes Uranium due in 1958 at 3,000 tpd. Mine and mill cost $26-million

COPPER

Chibougamau, Que. Merrill Island Mining Corp. expected to have 650-tpd mine and mill capacity in 1958, but will delay due to low copper price

Sudbury, Ont. Consolidated Sudbury Basin would have had 3,000 tpd capacity in 1958; operations suspended

Chile. Andes Copper will have El Salvador in production by 1959 at 100,000 tons per year metal. Cost will be $80-million

Toquepala, Peru. Southern Peru Copper Corp. plans to get into production in 1960 at 120,000 annual tons of blister. Total cost will be $200-million

Townsville, Queensland, Australia. Mt. Isa is constructing a 33,000 ton copper refinery

NICKEL

Sudbury, Ont. Arcadia Nickel Corp. expects to have 1,000 tpd mill capacity in 1958

Moa Bay, Cuba. Freeport Sulphur Co.'s Cuban American Nickel Co. project will cost $100-million for mine, mill and refinery. Production will be 50 million lb nickel and 4.4-million lb cobalt a year

OTHERS

Omal, Ohio. Olin Revere is building an 180,000 ton per year aluminum reduction works and fabricator. Entire project will cost $231-million

The Dalles, Ore. Harvey Aluminum's reduction works will go onstream in 1958 with 50,000 tons per year aluminum potential. Cost will be $44-million

Lake Gulch, Idaho. American Smelting & Refining Co. is sinking a shaft on Vulcan Silver-Lead's Galena silver property.

South Africa. Buffelsfontein will complete surface plant for 100,000 tpm mine and mill. Africa now has 17 gold-uranium mills operating. Surface plant cost will be $5-million

Milton, Fla. NRC Metals Corp. is building a 700,000 lb reactor-grade zirconium refinery. Cost—$7.2-million

Black Lake, Que. Lake Asbestos of Quebec will be in production in 1958 at 5,000 tpd ore. Cost for mine and mill will be $33-million, including dredging the lake

Projects Completed and In Production In 1957

MANGANESE

Amapa, Brazil. Bethlehem Steel Co. will produce 600,000 tons a year.

IRON AND STEEL

United States. A total of 18 sintering plants, capable of treating 25-million tons a year, were completed in 1957. Adding these to the 103 already in operation, the U. S. has in excess of 63-million tons of sintering capacity

Youngstown, Ohio. U. S. Steel completed a $10-million sinter strand

Aurora, Minn. Oliver Iron Mining Div., U. S. Steel, mined 2.6-million tons from the re-opened Stephens

Virginia, Minn. Oliver Mining completed a 33,000-tpd ore sizing plant for Rouchleau area mines

Minnesota. Pickands, Mather & Co. completed heavy-media plant

Hibbing, Minn. Snyder Mining Co. completed 200-tph washer

Bovey, Minn. Cleveland-Cliffs Iron Co. started mining in the Sally open pit; ore to go to Canisteo

Minnesota. M. A. Hanna finished the Hunner sizing unit

Calumet, Minn. J&L Steel Corp. has flotation mill to clean Hill-Annex mine tailings

Lovelock, Nev. Minerals Materials Co. installed a 300-tph magnetic separator plant

Port McNeil, B. C. Empire Development Co. Ltd. is now mining 1,800 tpd

Salzgitter, Germany. Large project completed.

URANIUM

Ford, Wash. Dawn Mining Co.'s 400-tpd mill onstream. Cost—$3.1-million

Mexican Hat, Utah. Texas-Zinc Minerals solvent extraction mill will handle 800 tpd. Cost—$7-million

Jeffrey City, Wyo. Western Nuclear Corp.'s 400-tpd mill cost $3.6-million.

Gunnison, Wyo. Gunnison Mining Co. has 200-tpd mill. Cost was $2-million

Blind River, Ont. Can-Met Explorations mill is onstream at 1,000 tpd; will peak at 3,000 in 1958. Cost was $20-million for mine and mill

Blind River, Ont. Consolidated Denison's 6,000-tpd mine and mill, the world's largest, will hit design capacity in 1958. May expand to 9,000 in future. Cost for mine and mill—$40-million

Blind River, Ont. Lake Nordic mine and mill onstream with with 4,000 tpd capacity. Cost for mine and mill was $26-million

Blind River, Ont. Stanleigh Uranium is onstream. Capacity is 3,000 tpd. Cost was $26-million

Bancroft, Ont. Greyhawk Uranium mining at 250 tpd. They will not build a mill as planned

Bancroft, Ont. Faraday Uranium Mines is running mill at 1,000 tpd, feeding their ore and Greyhawk's

Beaverlodge, Sask. Lorado Uranium Mines Ltd. opened at 500 tpd, will reach 750 peak in 1958. Cost was $9.2-million for the mill

Yellowknife, NWT. Rayrock Mines—150 tpd mine and mill

COPPER

Ore Knob, N. C. Appalachian Sulphides, Inc. opened 700-tpd mine and mill. Cost—$2.5-million

Pima, Ariz. Pima Mining Co. is mining and milling at 3,000 tpd

Tilt Cove, Newfoundland. Maritime Mining Corp. is mining and milling 2,000 tpd

Manitouwadge, Ont. Willroy Mines onstream at 800 tpd; designed for 1,000. Mine and mill

Manitouwadge, Ont. Geco Mines handling 3,300 tpd. Cost was $24-million for mine and mill

Kaskabowie, Ont. Coldstream Copper Mines at 600 tpd; will settle out at 1,000

British Columbia. Woodgreen Copper Mines Ltd.—1,000 tpd mine and mill. Company declared bankrupt

Duparquet, Que. Beattie-Duquesne Mines—400 tpd. Reported to be shut down

Salisbury, Southern Rhodesia. Mangula mine and mill opened. To produce 10,000 tons concentrate a year. Will erect smelter. Cost to date—$12-million

Chile. La Africana mine of Anaconda Co. is up to 500 tpd. Designed for 700 tpd

Negros Occidental, Philippines. Maninduque Iron Mines opened $5-million, 4,000 tpd mine and mill

Veracruz State, Mexico. Cia. Minera Zomelahuacan completed $160,000, 150-tpd flotation mill

ALUMINUM

Gramercy, La. Kaiser Aluminum opened $70-million alumina plant

Ravenswood, W. Va. Kaiser made first pour from $200-million reduction works. Capacity—145,000 tons

Baie Comeau, Que. Canadian British Aluminum Co. put first section of the reduction works on the line at 45,000 tons a year. Second 45,000 tons will be completed in 1958. Cost—$150-million

LEAD-ZINC

Austinville, Va. New Jersey Zinc Co. completed 2½-mile-long tunnel, connecting Ivanhoe with Austinville

Bathurst-Newcastle, N. B. Heath Steele Mines started mining and milling at 1,500 tpd

OTHER METALS

Rankin Inlet, NWT. North Rankin Nickel Mines is onstream at 250 tpd ore

Varennes, Que. Canadian Titanium Pigments completed their $15-million titanium pigment plant

Dunphy, Nev. Bootsrap Mine installed a 100-tpd cyanide plant to treat gold ore

Baguio, Philippines. Benguet Exploration Co. is mining and milling 50 tpd, 1 oz refractory gold ore

Transvaal, South Africa. Minerals Engineering Co., in joint venture with two other firms, opened 3.6-million lb per year vanadium concentrator

Boron, Calif. U. S. Borax and Chemical Corp. expanded operations by converting to open pit and building a new refinery to produce 800 tpd boron trioxide. Total cost was $30-million

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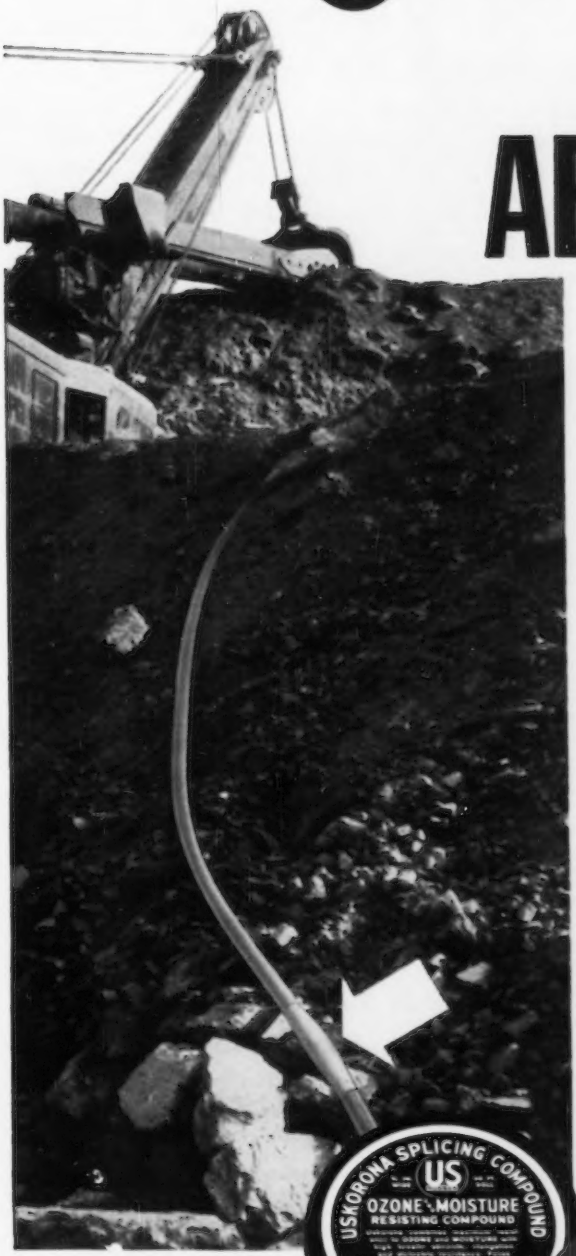

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United States Rubber

Niagara Falls, N. Y. Olin Mathieson Chemical Corp. opened $5.5-million boron rocket fuels plant. Second $4.5-million unit is under construction
Danvers, Mass. Metal Hydrides opened $5-million boron fuels intermediate plant
Elmore, Ohio. Brush Beryllium Corp. opened a $4.5-million beryllium metal refinery. 10,000 lb per month
Hazelton, Pa. Beryllium Corp. opened $300,000 beryllium billet plant. Capacity—100,000 lb a year
Chattanooga, Tenn. Heavy Minerals Co. completed a $6 million rare earths refinery
Germany. Mansfelder Huettenkombinat is producing 99.99% selenium by distillation

NONMETALS

Dillwyn, Va. Quarry and flotation plant completed at Kyanite Mining Corp.'s kyanite property
Kings Mountain, N. C. Cleveland Minirals and Carolina Mines Inc. opened kyanite mine and mill
Orange Park, Fla. American Cyanamid Co. started producing pebble phosphate from mine and washer
Pincher, Alberta. British American Oil Co. completed 225-tpd sulphur-from-sour-gas plant
Taylor Flats, B. C. Jefferson Lake Sulphur Co. completed 425-tpd sulphur-from-sour-gas plant
Montreal, Que. Laurentide Chemicals & Sulphur Ltd. completed 100-tpd sulphur-from-waste-gas plant. When all by-product sulphur recovery plants now under construction in Canada are completed, Canadian annual by-product sulphur production will reach 1-million tons (1960)
Goderick, Ont. Sifto Salt Ltd. is sinking shaft in rock salt deposit
Carlsbad, N. M. National Potash Co.'s $19-million potash project onstream at 1,200 tpd
Kinpro, N. C. Lawson United Feldspar & Mineral Co. opened 8,000-tpm feldspar mine and mill
Oregon. Great Lakes Carbon began stripping of northern Lake County diatomaceous earth orebody. Ore will be shipped to mill at Lower Bridge
Bonanza, Utah. American Gilsonite completed mine, 72-mile pipeline and gasoline refinery. 700 tpd. 1,300 bbl per day gasoline. Cost was $18-million
Eastern Township, Que. Carey Canadian completed 2,000-tpd asbestos mine and mill. Cost—$8.5-million

These Companies Completed or Announced Expansion Programs

IRON AND STEEL

Eagle Mountain, Calif. Kaiser Steel Corp. is boosting output by 40%, to raise ingot steel production to 3-million annual tons. Total of $194-million will be spent, including a fourth blast furnace at Fontana
Michigan. Cleveland-Cliffs will expand mining and pelletizing facilities at Republic and Humboldt
Sorel, Que. Quebec Iron and Titanium expending $16-million. Three new electric furnaces will be added by 1959

URANIUM

Bancroft, Ont. Bicroft Uranium raised rate to 1,500 tpd
Blind River, Ont. Pronto Uranium raised rate to 1,500 tpd
Beaverlodge, Sask. Eldorado expanded milling to 2,000 tpd

COPPER

Nevada. Consolidated Coppermines is spending $17-million on expansion and diversification into oil and gas
Chibougamau, Que. Opemiska Copper Mines boosted mill capacity to 800 tpd, then to 1,600 tpd and will raise it to 2,400 in 1958
Noranda, Que. Noranda is raising production capacity from 1,00,000 to 135,000 tons metal. A third reverberatory has been added
Chile. Minera Disputada de Las Condes, Santiago, will expand low-grade copper ore output to 3,000 tpd
Chile. Compagne Miniere du M'Zait raised El Cobre flotation mill capacity to 700 tpd; plans further increase of 2,000 tpd
Mexico. Cananea Consolidated Copper Co. has requested government permission to spend $20-million in the next 10 years to develop two underground mines
Northern Rhodesia. Mufulira is spending $39.6-million to be at 155,000 tons of red metal a year by 1962

NICKEL

Sudbury, Ont. Falconbridge Nickel is expanding smelter for nickel and copper production by about 20%. Enlarged smelter will have capacity for 55-million lb nickel and 25-million lb copper by the end of 1958
Ft. Saskatchewan, Alberta. Sherritt Gordon expanding

ALUMINUM

Listerhill, Ala. Reynolds completed part of reduction works expansion—now at 190,000 annual tons aluminum.
Wenatchee, Wash. Aluminum Co. of America is adding $10-million potline (No. 5)
Surinam. Billiton is raising bauxite output from 800,000 to 1,250,000 annual tons
Quebec. Aluminum Ltd. planned to add 80,000 annual tons to reduction capacity, then cut back expansion. When current expansion is completed in 1960, Aluminum will have spent nearly $1-billion on expansion

LEAD-ZINC

Kellogg, Idaho. Bunker Hill Co. increased electrolytic zinc output by 25%. Will spend $15-million over the next five years on further expansion
Trail, B. C. Consolidated Mining & Smelting Co. is spending $1.6-million to modernize slap zinc plant
Australia. Electrolytic Zinc Co. planned to increase capacity to 115,000 annual tons in 1957, and to continue expansion toward 140,000 tons
Zacatecas, Mexico. Penoles will expend $1,450,000 to extend mine life

OTHER METALS

Kirkland Lake, Ont. Macassa Mines is upping gold ore capacity to 500 tpd
Porcupine, Ont. Aunor Gold Mines is expanding from 600 tpd reached in 1957, to 750 tpd ore
Expinar Province, Peru. Hochschild & Cia. is expanding lead-silver ore production to 200 tpd
South Africa. Rustenburg Platinum is expending £1.8-million to raise ore production to 2.5-million tons a year, boosting platinum output by 80%

NONMETALS

Thetford, Que. New plants and expansion now under construction will raise area's asbestos capacity from 11,500 to 60,000 tpd ore
Thetford, Que. Canadian Johns-Manville Co. spending $2-million
Thetford, Que. Nicolet Asbestos raised ore capacity from 2,500 to 3,600 tpd
Thetford, Que. Asbestos Corp. is reconstructing the Beaver mill to 5,000 tpd ore capacity. Cost—$5-million

But Watch These Hot Spots For Further Developments

Maine. Million-acre aerial survey underway by the State. Some 14 mining companies exploring mining's next mineral province for the extensions of Quebec and New Brunswick structure
Argentina. Mendoza Province—Coney Argentina S. A. has large concession
Brazil. Government is encouraging exploration for ore
Colombia. Offering incentives to foreign capital
Dominican Republic. Many U. S. and Canadian interests
Honduras. Mining laws are being reorganized to attract foreign investors
Nicaragua. Studying mineral potential; enacting new mining law
Union of South Africa. Government-owned Rhodesia Railways is looking for concessionaires willing to spend $300,000 per year for next five years in exchange for exclusive mineral rights in northern Cape Province

MANGANESE

Chilili, Northern Rhodesia. Vanadium Corp. has concession

IRON AND STEEL

Dillon, Mont. Minerals Engineering Co. is considering washer and mine to cost about $6-million, producing 500,000 tons per year
Klukwan, Alaska. U. S. Steel is pilot plant testing iron sands on the Klukwan Reservation

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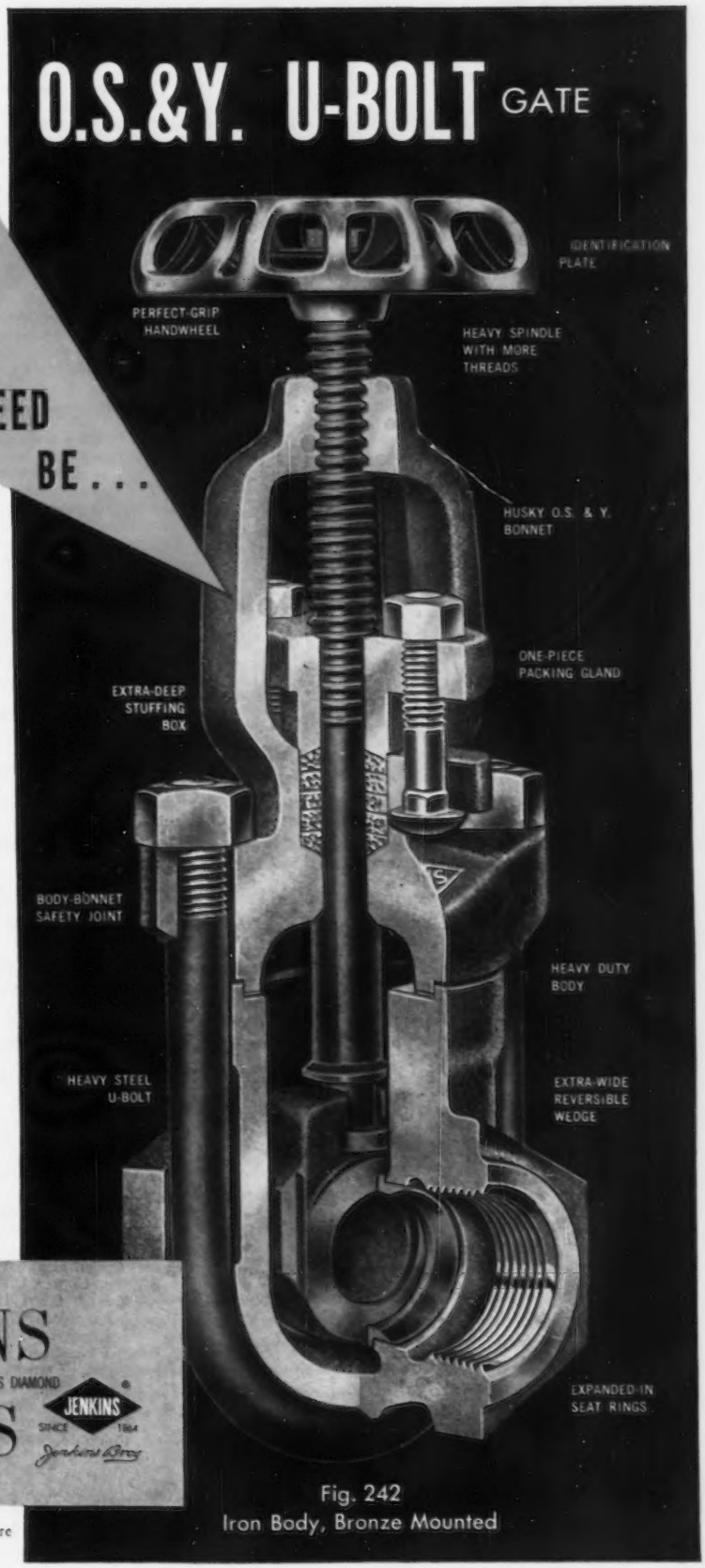

Fig. 242
Iron Body, Bronze Mounted

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MINES, MILLS AND SMELTERS

Wisconsin. Iron County has 28,800 acres of potential iron land. and is negotiating with mining company
Michigan. Inland Steel is drilling Macdonald property
Atlantic City, Wyo. U. S. Steel will decide in April 1958 whether or not to mine and mill Wyoming iron. Estimated construction cost—$16 million
Newton Falls, N. Y. W. S. Moore Co. testing near Benson mine; may build 400,000 annual ton pelletizer
Brazil. Huge iron reserves, close to 20-million tons discovered in Minas Gerais
Chile. Mitsubishi is drilling Copiapó orebody
Chile. Large discovery made at Lebu; being financed
Mexico. After having proved up 150-million tons of ore, Colorado Fuel & Iron had its Pena Colorado concession withdrawn by the Mexican government
Labrador. Pickands, Mather & Co. may develop property with Canadian Javelin. No definite plans as yet
Hines Creek, Alberta and B. C. Some 1-billion tons ore may be possible
Bruce Lake, Ont. Oglebay-Norton Co. is interested in large low-grade orebody. Cost would be about $35-million
Highland Valley, B. C. Copper-iron discovery at Craigmont Mines Ltd. may hit 100-million tons
Nakina, Ont. Anaconda Co. exercised option on large high-grade property. No definite plans as yet
Marmora, Ont. W. S. Moore has options
Ungava, Que. Cyrus Eaton and Krupp are planning large project
Matawin Iron Range, Ont. Monpre Mining Co. has estimated 175-million tons
Baffin Islands. Detroit group found estimated 150-million tons of low-grade
Savage River, Tasmania. Rio Tinto is prospecting
New Zealand. Philipp Bros. is investigating possibility of erecting 500,000 annual ton pig iron plant to treat some 700-million tons of beach sand iron
Queensland, Australia. Broken Hill Co. is exploring
New Zealand. Taranaki may be the sight of mine, mill and smelter to produce 250,000 tons steel annually
Liberia, Africa. At least five large iron deposits have been discovered. Government wants concessionaires
South Burma. Japanese firms plan to open pit Victoria Point discoveries

COPPER

Michigan. U. S. Metals Refining Co. is drilling near Wakefield
Michigan. American Metal has discovered 105 million tons of 1% metallic copper in Upper Peninsula
East Pima, Ariz. Asarco has some 65-million tons so far in the Papago Reservation
Jerome, Ariz. Becchetti Copper Corp. claims to have found large chalcopyrite deposit
Washington. Bear Creek has paid $120,000 toward $450,000 purchase price on copper claims at Glacier Peak
Mattagami, Que. Newmont has taken large claim interest
British Columbia. Bethlehem Copper has 100-million ton potential
Saskatchewan. Flin Flon-La Ronge area had staking rush in 1957
Ungava, Que. Asarco is exploring major find at Cape Smith
Chile. Compania Minera Tamayo made discovery running 13% Cu at Las Chivas
Chile. Mauricio Hochschild is seeking method to treat complex Cerro Blanco deposit
Southern Rhodesia. Capricorn Minerals has 12% Cu strike
Transvaal. Newmont and Rio Tinto are spending $3-million to explore Phalaborwa; estimated cost of project is $75-million
Tasmania. First new copper strike in 50 years was made recently at Mt. Lyell
Philippines. Newmont and Atlas Consolidated Copper
Poland. Large copper strike reported at Legnica

NICKEL

Southern Rhodesia. Rio Tinto paid $700,000 for Empresa Nickel claims
Ungava, Que. Large strike made. Inco and others interested. Union Carbide and Perron Gold Mines exploring
Quebec. Val d'Or-Malartic area was heavily staked in 1957

ALUMINUM

Wyoming. Reynolds Metals holds coal land options. 161,000 volt transmission line completed at Lake DeSmet
Montana. Anaconda is building alumina-from-clay pilot plant. 10,000 tons of clay delivered to Anaconda
Kentucky. Alcoa took options on 12,000 acres and mineral rights in Crittenden County
South Carolina. Alcoa has 26,000 acre option on alumina bearing lands in Spartanburg area
Brazil. Kaiser International named Glycon de Paiva a vice president. Extensions of Guiana bauxite into Amazon Valley may be tapped
Jamaica. Harvey Aluminum has prospecting concession
Panama. Kaiser Aluminum has concessions
Costa Rica. Alcoa is exploring
French West Africa. Alcan will participate with Pechiney and Ugine, with target date for metal production in 1964. Hydro plant must be built first
Africa. Billiton, Olin Mathieson and European aluminum firms have large prospecting grant in Angola
Queensland, Australia. Consolidated Zinc Corp. has mining rights to Cape York bauxite. Power plant being considered. Alcan and Reynolds also are looking for permission to explore
Hawaii. Mining laws to control bauxite mining are being prepared

TITANIUM

North Carolina. Beach deposits are being examined
Florida. At least two major mining companies hold Trail Ridge properties and are planning mines. Another holds over 100 miles of coastal land
Georgia. Columbia Isle, off the coast, is the site of a prospective mine. Major paint maker interested
New Jersey. Large strike made in 1956 is being investigated
Africa. Large beach sand project in the works for Sierra Leone

LEAD-ZINC

Quebec. Mattagami Syndicate has reportedly made a large strike at Watson Lake
New Brunswick. Bathurst-Newcastle area. Many companies with large properties. Heath Steele mine and mill went onstream late in 1957
Australia. Mt. Isa Mines has made 10% lead carbonate strike in Queensland
Guatemala. Many companies here. High-grade carbonate and galena strikes made
Chile. Cerro de Pasco is exploring Niriguao area
Utah. Bear Creek has shaft down in East Tintic area
Peru. Ventures may erect mine and mill at Chavin if orebody is large enough. Estimated cost is $1.5-million

OTHER METALS

Maine. Dow Chemical purchased lithium claims at Thomaston
Colorado. Miracle Mines Ltd. claims to have made large placer platinum discovery in Walden area
Val d'Or, Que. Quebec Lithium may build refinery
Tanganyika. Billiton has made large columbium strike and is running a pilot plant program
Australia. Maranboy tin fields may be opened

NONMETALS

Idaho. Stauffer Chemical has large phosphate orebody at Hot Springs area
North Carolina. Kennecott Copper had large lease in Beaufort and Hyde Counties. Will test for phosphate. International Minerals, Monsanto Chemical and others are looking
Southern Rhodesia. African Explosives & Chemical Industries will run pilot test on 20-million ton phosphate discovery
Saskatchewan. Two mines and mills already announced. Many companies hold potash leases
Sicily. Rich potash and sulphur deposits uncovered
Sudbury, Ont. Inco and Texas Gulf Sulphur are running a 10-tpd pilot plant, recovering elemental sulphur from smelter gases at Copper Cliff
Poland. Some 11-million tons of sulphur-bearing ore has been discovered. Government plans mills for 500,000 annual tons output by 1967
Newfoundland. Advocate Mines claims an estimated 30-million tons of asbestos ore at Baie Verte
Greece. Austro-American Magnesite Co. will mine Vavdon magnesite deposits
Nevada. American Colloid Co. purchased barite claims
Colorado, Wyoming and Utah. U. S. oil-shale oil reserves are in excess of 1.8-trillion barrels. Many oil companies searching for method to extract. Estimates from one source say that 500,000 tpd must be mined and cracked to be economic at this time•

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Working at a large open-pit copper mine in Arizona, a fleet of 34-ton "Eucs" maintain high production at low operating and maintenance cost. Their dependable performance and high job availability make "Eucs" an important part of the profit picture on this and many other mine and quarry operations throughout the world.

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

Mining Practice

Lloyd E. Antonides
Associate Editor, E&MJ

Mining was no rest camp during 1957, yet there were no brilliant advances to match post-World War II successes of hard carbide in cutting, simple bolt in supporting and cheap fertilizer in breaking rock. These and other elements (see *E&MJ* 1956 and 1957 Reviews and Guidebooks) continue to overrun initial limits. Here are other routes of advance that are being probed:

IN DEVELOPING orebodies for exploitation, spurs to progress are the increasing depth of mining and the investment saving gained by rapid development. Open pits are reaching 800 ft in depth and the new Western Deep Reefs gold mine is projected to reach 12,500 ft in nine years.

Investment and specialization required for men and equipment on such work are promoting a trend to outside contracting. South African shaft sinking crews were reported hired for projects in Britain, Canada and Germany. In South and North America the use of construction companies is now a fairly common consideration—not only for stripping but also for shaft sinking.

Stripping of semi-consolidated overburden has reached the point where 2,000 cu yd per machine-hour gets no headline. Size of machines is staggering. For dry digging "Big Paul the King of Spades" is the latest entry. This coal stripping shovel has a working weight of 2,900 tons, a reach of 150 ft and a 70-cu yd (105-ton) bite. More of the huge German bucket-wheel and bucket-line dry dredgers—somewhat smaller in weight and output though occupying more space—are being made for use in Australian and German coal fields. A second 1700-ton walking dragline with 20-cu yd bucket and 250-ft reach went to work at a British iron pit. It compares with 30-cu yd, 190-ft reach unit which recently moved to a new location on the Mesabi. Shovels give capacity, draglines give reach and dredgers are a compromise.

Hydraulic dredging remains a proved low-cost excavator on loose material. Extension of the method to cemented deposits was given a boost by a new British cutter head. One or two rotating discs with replaceable straight 9-in. alloy steel picks, fitted secant-wise around the edge, are mounted on each side of the head with their plane of rotation parallel to the boom axis.

Shaft sinking at Free State Saaiplaas gold mine set a new record with excavation of 834 ft of 30-ft dia vertical shaft in 30 days during September. On the 6400-ft No. 2 shaft, master sinker J. Jordaan is supervising 22 white and 240 native miners working round-the-clock using jackhammers for drilling and a 20-cu ft cactus grab hung from a carriage on a centrally pivoted bridge for loading three 185-cu ft (9¼-ton) hoisting buckets (see *E&MJ* August 1957). Concrete lining was poured 810 ft in same period but no dividers were installed. Site had been pre-cemented to 2240 ft. With the start of sinking at Western Deep Reefs' two twin 6000-ft shaft systems, talk about cracking the 1000-ft rate looks less nebulous.

It is established practice on these projects to erect permanent head gear—usually concrete—before full scale sinking is begun. Unsubstantiated and lacking in detail is a Russian claim of 869 ft in one month. Russians, like Germans, seem to prefer brick lining.

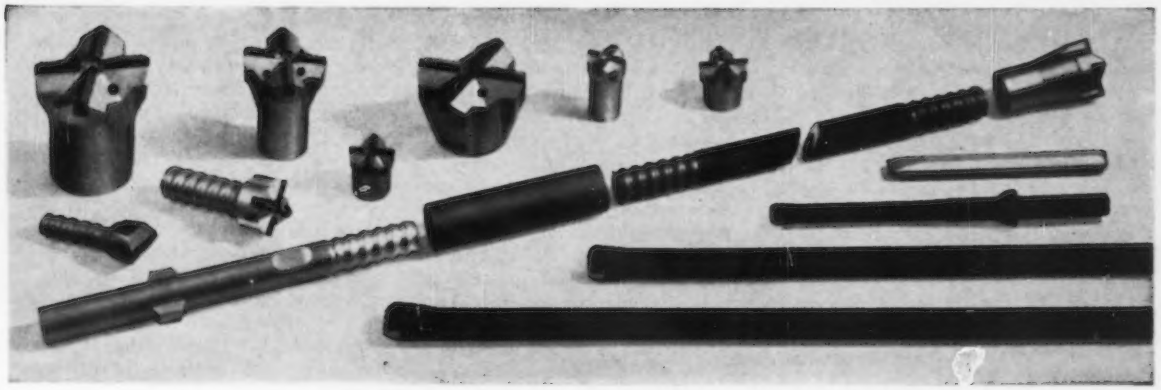
Tunneling apparently has reached its peak rate on hydroelectric projects. On California's King's River job, crews have driven the 13-ft horseshoe opening through granite as much as 142 ft in one day and 834 ft in one week. In northern Sweden an 88x52-ft tunnel (see *E&MJ*, July 1956) was advanced 1120 ft in one 20-day month.

In making smaller access openings there is a desire for longer cycles. Burn cuts with large (2½ to 9-in.) unloaded relief holes permit longer rounds. In Missouri, St. Joseph Lead Co. researched to success a 12-ft drift round of that type. In Sweden and Germany the principle is applied to raising with long holes. Blasting must insure a clean break-expel on each hole. Since burden and relief volumes bear a critical relationship, length is limited by drill hole deviation. Drilling of large hole is being tackled with underground churn drills and rotary roller-cone drills for vertical work. For horizontal work, a U. S. tunnel contractor is reported trying a down-the-hole percussion quarry rig, and the Germans have adopted rotary roller-cone rigs.

Boring of openings is a growing practice in U. S. and Germany. Inherent strength of circle plus resulting smooth unfractured face minimize lining requirements. For vertical openings small friction-drive hoisting equipment is a related development. Although percussive action of churn drill is still favored for producing thrust needed to open and ream large holes in hard rock, rotary mechanisms have been developed for use on rocks up through medium-hard limestone and sandstone. Although in soft material, full-opening, continuous rippers or borers are economic, coring type devices look best as harder material is tackled. Principle of widening a pilot opening requires less power, too. Britain and Russia have announced trials of machines almost identical to the U. S. Robbins tunnel borer (*E&MJ*, September 1955 p 39) which uses counter-rotating, concentric arms bearing tungsten carbide prong teeth to cut kerfs and rollers to press-shatter resulting ridges. Notched discs rolling along centerline of ridge promise more success in hard rock.

Perhaps the proven economic use of tungsten carbide inserted roller bits on hard taconite blastholes will further extend application of rotary devices that use them (*E&MJ*, October 1957 & Mid-June 1956).

Development muck-handling units (see *E&MJ*, Mid-June 1956 and 1957) have three newcomers. To simplify removing muck from inclined shaft at Morning Star mine in Australia, monorail trolley was installed along center line of hanging wall. It acts somewhat like bucket cross-head for vertical shafts. Main hoist rope comes from winder, passes over fixed sheave on trolley, hangs down in bight and then fastens to trolley. Single-pulley block is placed in bight. Loaded bucket is hooked to block, and as hoisting starts, bucket rises vertically



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You know as well as we do the advantages of buying all your drilling equipment from one supplier. These advantages become still more evident if you buy from the Sandvik Range. The Sandvik Steel Works are the world's largest manufacturers of tungsten carbide for rock drilling. Their production covers integral steels, detachable bits, extension steels and stone working tools—all made of high-quality Swedish alloy steel, all fitted with the well-known Coromant tungsten carbide inserts.

Integral steels with 50% longer life

Sandvik Coromant integral steels have up to 50% longer rod life than ordinary steels, thanks to anti-corrosion SR-treatment, which protects them during transport, storage and actual drilling. In addition, air-tight plastic caps give bit and shank extra protection during transport and storage. They are available in these standard sizes:—

$\frac{7}{8}$" hollow hexagon	1'4"-13'1"
$\frac{7}{8}$" hollow hexagon	1'4"-21'0"
1" hollow hexagon	2'6"-21'0"
Flexible drill steels	2'7"-31'6"

Precision-made rock bits

The threads of Sandvik Coromant (cross and X-design) bits are precision milled. The bits are so accurately manufactured that not only smoother drilling but *longer life* are ensured. Standard bit diameter sizes range from $1\frac{1}{2}$" to $4\frac{1}{2}$". The 773 bits (bottoming type) are available with GD400 and GD600 thread, or with $1\frac{1}{4}$", $1\frac{1}{2}$" and 2" rope thread. The 776 bits, for standard shoulder-type drill rods, are available with threads ranging from $\frac{7}{8}$" to $1\frac{11}{16}$".

Efficient extension steels

The rope-threaded joints of Sandvik Coromant extension steels are solid and make joining and unscrewing extremely easy. Sizes available: $\frac{7}{8}$" and 1" hexagon steels, $1\frac{1}{4}$" and 2" round steels. A special feature of the $1\frac{1}{4}$" equipment is the $\frac{1}{2}$" flushing hole, about twice as large as most. This gives better cleaning of the bore hole and a higher rate of advance, reduces wear and risk of steels sticking. The 'cold rolling' technique makes this wider flushing hole possible *without any loss of strength.*

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A single plug hole steel made by Sandvik is capable of drilling up to 1000 holes, each about 3.9". Sandvik Chisel Steels are made with rubber sleeves to reduce vibration and protect the worker. Sizes available: Plug Hole Drill Steels with bit diameters ranging from approx. $\frac{31}{32}$" to $\frac{7}{8}$". Chisel steels with bit diameters from approx. $\frac{5}{16}$" to $\frac{23}{32}$".

The World's foremost drilling unit

Sandvik Coromant extension and drill steels have been developed in close co-operation with Atlas Copco, manufacturers of rock drills and other compressed air equipment. The combination of Sandvik steels and Atlas Copco rock drills is the world's most widely used drilling unit—responsible for the drilling of more than one thousand million feet each year!

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DS577A

until bight closes, then trolley and bucket move up shaft together. Blasting aims at throwing muck toward hanging.

For loading out a complete drift round, the Whup-'d-Whup scheme (*E&MJ*, June 1956) has grown considerably in size. On a tunnel in El Salvador a 1½-cu yd overcast diesel crawler loader dumps into the first of three 50-ton cars. A slusher, riding on car-top rails and inter-car aprons, pulls muck back from sheave on first car to hoist on last. In Germany a "bunker train" consists of as many as 22 overlapping open-ended cars (totalling 1250-cubic ft capacity) with scraper chain conveyor in bottom. Overcast loader dumps into one end.

Production

Breaking rock on surface is witnessing rising interest in jet piercing. No newcomer, this non-contact drilling method has been a boon to taconite miners. Basic idea of heat-spalling rock is prehistoric but use of ultra-modern high thrust jet flame is real key to its success. It is proving its worth on nepheline syenite in Canada and U. S. and a contractor on St. Lawrence Seaway is highly enthusiastic over its performance in Potsdam sandstone. For drilling 1000 cu yd the contractor compares his experience as:

	Net cost	Time
Jet piercer	$350	4½ hr
Churn drill	480	50
Rotary roller cone	710	16½
Small hole percussion	800	41

Increased use of jet piercing with its oxygen requirement may encourage renewed interest in liquid oxygen explosive (LOX). Reportedly even cheaper than AN, its safety aspects are no longer a real obstacle—especially with development of new carbon absorbent called "Nerex."

Horizontal holes are also getting renewed attention. Their advantages are concentration of explosive in harder rock under weak formations and keeping work all on one level. Large rotary-roller-cone and percussion quarry-rigs appear successful in horizontal position. More rugged horizontal augers are giving a new boost to the approach on the Mesabi. Loading difficulties are being solved and labor cut 13% at Bingham Canyon with a pneumatic loader for blowing in AN and fuel oil. A mechanical tamper has been developed by Peabody Coal by which jointed pole sections carried on large reel, are moved in and out with rubber friction-wheels. It cut loading labor over 50%.

Vertical, 5.9-in. up-holes have been adopted for drilling high (plus 164-ft) benches in Germany. Rotary rigs are used in small chamber at end of short adits from quarry floor.

Ammonium nitrate, made cap-sensitive by using 5% nitromethane as the hydrocarbon, is an efficient explosive, according to United Electric Coal. But best over-all practice as stated at Missouri symposium (*E&MJ*, January 1957) is to dump in a 94/6 weight percentage of prilled AN and No. 2 fuel oil (i.e., about 5 pints per 50 lb). As such it is equivalent to 50-60% dynamite on a pound-for-pound basis. It is effective in plus 1½-in. holes using two 1½x8-in. sticks of 50% gelatine dynamite as primer although more primer is good insurance. Benefits of multiple point priming and especially an "overdrive" effect (raising detonation velocity above its inherent one point detonation rate) were discounted. But a California pit finds use of 1-ft strips of 400-grain detonating fuse taped at 3-ft intervals to a 50-grain detonating fuse is a highly successful primer for 4⅝-in. holes.

Some empirical formulae for blasting 4- to 9-in. quarry holes with 3¼- to 8-in. "gelatinous" explosive cartridges were offered by T. W. Edmonds (*Mine & Quarry Engineering*, June 1957). They can be summarized as follows:

$$W_x = W_R S_c \div 144{,}270$$
$$B = 44\ d_x$$
$$S_P = .83\ B$$
$$S_S = .8\ S_P$$
$$L_c = \tfrac{2}{3} \text{ to } \tfrac{2}{3}\ L_H$$
$$L_s = >B$$

W_x = lb of expl.
W_R = tons rock
S_c = psi compress. strength of rock
B = burden*
d_x = dia expl.*
S_S = spacing in rows normal to joints*
S_P = spacing in rows parallel to joints*
L_c = length of charge*
L_H = length of hole*
L_s = length of stemming*
* in ft.

For breaking rock underground, drill steel has reached high level of perfection (*E&MJ*, November 1957) and bit-rod connection is under close scrutiny. Simple conical taper looks like best answer but as yet has not been universally accepted (AMC, September 1957). Rope thread has increased somewhat in popularity. Demand for standardization of sizes, threads, etc. is growing. New tough, hard cermet materials are rousing interest in applying them to rock cutting elements. Use of small amounts of chemical agents in drill flushing-water to soften hard rock should command closer inspection—Russians now use them. Pilot-style bit has merit since it not only gives an additional relief-face but also apparently stresses surrounding rock which makes fracturing easier (a characteristic of rock which also aids success of millisecond delay blasting). Theoretical advantage of pilot bit design is also supported by fact that a hole is much easier to drill if very close to a prior hole. St. Joseph Lead Co. found such bits to be most efficient for drilling large hole for burncut.

Machine-wise, small down-the-hole jackhammer unit is available but the real interest continues to be in rotary-percussion. Basically R-P aims at achieving high speed penetration of rotary drag drills and at same time reducing high thrust requirement (especially in hard rock) and its accompanying bit wear by using percussion. Tests are showing advantages—although not phenomenal—and bugs are being worked out. At least one operator is puzzled by the apparent lack of enthusiasm on part of manufacturers. Comments also cite that: prices of machines vary considerably; thrust and rigidity requirements need simplification; and air consumption—fairly high—has been reduced by adoption of hydraulic mechanism for rotation.

Adoption of supersonic vibratory devices to rock drilling continues to raise eyebrows but no commercial company appears to have done anything with them as yet.

Underground blasting with fertilizer grade ammonium nitrate is not too great a problem according to view of some experts—good ventilation and sufficient waiting time could solve fume obstacle. Loading of loose explosives with pneumatic blower into long holes is safe and efficient at Norway's Skorovas pyrite mine. As with the Swedish stick-powder blower, hints of objections to its use in U. S. and elsewhere remain unspecified.

Less rugged, less expensive detonating fuses are coming into wider use to insure full-hole detonation and to link holes. A new plastic connector is simpler and quicker than clove hitching. At Carey iron mine in Wisconsin, ground potentials prohibited use of electric caps, but when it was discovered that power applied to a wrapping of No. 14 lead wire would set off Ignitacord, a new remote electrical firing method was born.

Reflection or tension-slabbing theory or rock fracturing seems fairly well accepted and is leading many

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For immediate breathing protection in emergencies caused by fire or explosion, M.S.A. developed the Self-Rescuer. This approved safety item provides the precious minutes of emergency breathing protection so vital to those traveling through carbon monoxide contaminated atmosphere to fresh air.

The Self-Rescuer is available in individual carrying cases or in Cache Assemblies for storage in working sections, on mantrip cars and along conveyor lines. U. S. Bureau of Mines Approved. Bulletin No. BC-1.

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Under the hardest physical conditions, so often required in fighting and sealing mine fires, re-establishing ventilation, and rescue operations, this apparatus gives the wearer complete breathing protection in any unbreathable atmosphere for a minimum of two hours. U. S. Bureau of Mines Approved. Bulletin No. BB-3.

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groups to examine blasting practice more critically.

Hydraulic jet mining of easily broken mineral is now practiced underground on gilsonite in Utah and coal in Russia.

Ground control and support is often related to underground mining only. But pit operators who failed to keep rock mechanics in mind have run into problems. To combat moisture—the major bug-a-boo on surface since it reduces cohesion as well as causes movement due to freeze-thaw volume changes — electro-osmosis schemes look good for partly consolidated material that does not drain easily. Apparently, taking a page from surface experience, chemical stabilization of poorly consolidated ground was reported successful underground at Steep Rock, but details are lacking.

Also underground, plastics are an eye-catcher. Non-cracking, sprayed-on coatings have proven useful to prevent spalling. Now USBM tests indicate epoxy resins have promise for bonding strata together to form thick beams in place of rock bolts. There are possibilities of extending their use to cementation of fractured ground. Concrete grout has become the most common possible-course-of-action to seal off water or to eliminate spiling or shields. The resin has advantages of low viscosity, quick setting and strong cohesion and adhesion.

To de-stress rock that is susceptible to rock-bursts, practice of blasting drillholes deep in solid face is gaining favor. Apparently the effect is to speed enlargement of low-stress (intradosal or fracture-failed) zone that probably develops around most openings. This results in a buffer within which stress builds up by inter-particle friction rather than by strain at boundary of opening.

For primary muck handling, both on surface and underground, more properties are catching on to the low initial cost and operating flexibility of rubber-tired front end loaders. They now come up to 6 cu yd in size. One of this year's eye-catchers is a British tilting fork-lift tractor which trams detachable muck pans. A small hydraulic swing dipper-shovel mounted on a tractor is a U.S. announcement. The familiar contractor's Gradall—a digger that has a hoe-like bucket which folds in toward operator and which is on end of a twistable and extensible arm which, in turn, is on a rotating table mounted on a truck chassis—has proved a handy mucker in a small iron ore pit in Tennessee.

On surface, most of the mammoth muck handling units (70-yd shovels, 90-ton trailer trucks), are used on overburden. But at Eagle Mountain iron pit, a 64-ton semi-trailer rear dump hauls ore. Standardization of truck specifications by inter-company Mesabi "Range Mechanical Committee" has resulted in manufacturers offering improved field-demanded units.

Underground, an air-powered, rubber-tired tram-car has been production proven in Italy. It is similar to several U.S. diesel models. One of the Italian models has an integral overcasting shovel which places it alongside the Gismo as a self-loading transport. A rubber-tired, air-powered overcast loader is arousing some interest. A fast-traveling, low-body, rear-dump diesel truck is proving better than shuttle car when runs get up to 1,000 ft—between 2,000 and 4,000 ft demands a 10-tonner rather than original 6-tonner. At Germany's Liepzig fair, a gathering-head type loader with two rotating, cleated discs instead of lugged-chain or arms caught viewers' fancy.

For rail haulage underground—large cars, aprons between cars to cut loading spillage, remote control for locomotives at loading and dumping points, and adoption of other well-publicized practices (good ballast, heavy welded rails, cushioned trolley, automatic switches and signals, etc.) are tried and proven ways to cut operating costs sharply. Where mud caused low traction, an iron mine found a light water spray from locomotive kept rails clean and eliminated build-up of sanding material.

Belt conveyor problem of guiding muck toward center of belt was cheaply solved at one mine with old-rubber-tired automobile wheels that turn freely on axles mounted along each side near loading point. The German steep-climbing, short-turning "Folded-Belt" conveyor (*E&MJ*, Aug 1955, p 35) still generates considerable interest but no U.S. installation has been announced.

Hydraulic movement of muck horizontally (Florida phosphate, Ohio coal) and vertically (Utah gilsonite, South African gold) continues to be a fertile field for investigation. Forida practice is to pump at about 33% solids (1.25 SpG) for a mean of two miles at 3½c per ton mile. South African example has vertical lifts of 1500 plus 2950 ft at 1.1 to 1.125 SpG through 6-in. pipe.

Hoisting automatically is reported quite successful overseas but a number of U.S. testers say reliability and maintenance aspects are not yet very favorable. TV monitoring is reported of help at one property. Nylon coating on hoist rope is claimed to cut wear and corrosion. A magnetic rope tester is available for detecting corrosion and broken wires—also an isotype X-ray scheme is reported in Europe.

Water control and drainage headlines also come from underground in South Africa. Merriespruit's successful dewatering scheme of using shaft skips to bale out 6-million gal per day has resulted in other mines adopting stand-by water skips. Cooperative effort of gold mines in Orange Free State to treat huge volume of brackish mine drainage has resulted in work starting on world's many-times-largest desalting operation—an electro-dialysis plant to handle 3-million gal per day at Free State Geduld. Western Holdings proved its feasibility with a 1,000-gph plant.

Power distribution losses are being reduced by using smaller, movable transformers close to production site. Compressed air practice is following a similar trend. Electro-hydraulic mechanisms are proving advantageous for shovel-loaders and rotary drills.

Maintenance and repair shops, as well as supply rooms, are being moved underground more and more. Multi-purpose lubricants are close to the operator's heart. Roving crews and vehicles cut over-all maintenance time; but operator must still clean, lubricate and adjust for best efficiency. Standardization efforts demanded by operators will promote better equipment performance. Special training of mechanics is becoming a must because on-the-job schemes take too long. It helps to give equipment user some of this, too, since mechanization is becoming more complex.

Communication equipment which permits use of voice is superior to other audio-visual means, but reliance on only one means is not advisable. A great many operators are working on schemes. Underground, the sound-powered telephone is a real boon. On surface, new pocket transceiver radios should prove likewise. Automatic control of materials handling equipment is being called for in spite of a general complaint that reliability and maintenance features are poor if several inter-related functions are involved.

Safety and health aspects are highlighted by: efficient electrically pow-

(*Continued on p. 188*)

OPERATING IDEAS

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. . . remember that the "equal" is possible only in two respects: price and nameplate specifications. You can't match the *long-run power* of Allis-Chalmers motors.

Double-shielded bearings guarded against dirt and over-greasing . . . provision for elimination of moisture condensation . . . practically indestructible rotor design . . . more cooling surface . . . more iron and copper content — these are the features (with others) that make up long-run power. These are the features that give Allis-Chalmers motors "plus" performance that can't be equalled.

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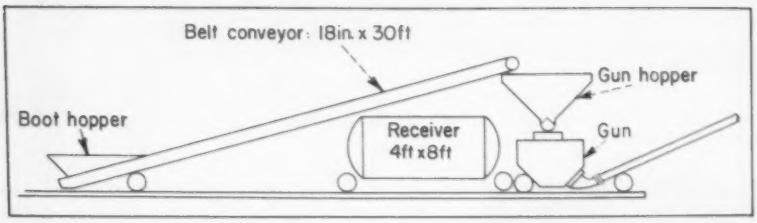
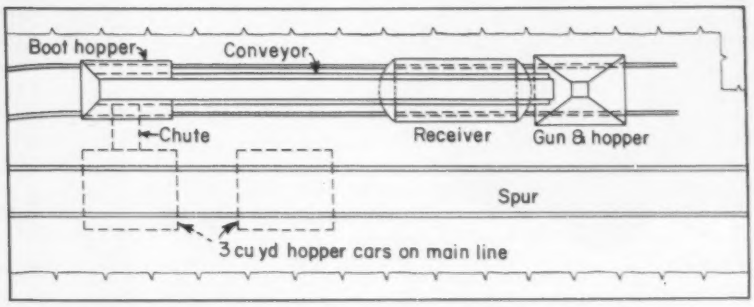
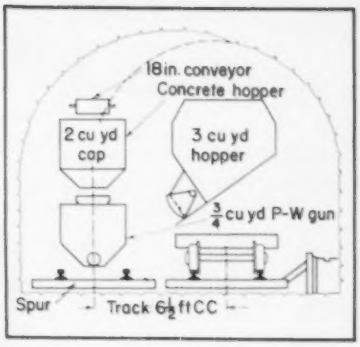
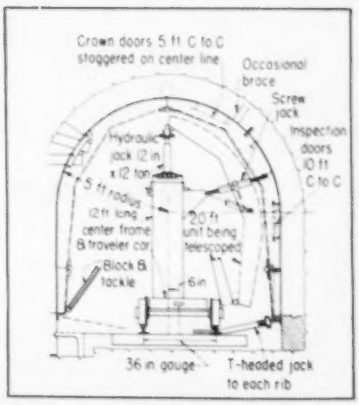
OPERATING IDEAS








Crown doors 5 ft C to C staggered on center line
Occasional brace
Screw jack
Inspection doors 10 ft C to C
Hydraulic jack 12 in x 12 ton
5 ft radius
12 ft long center frame & traveler car
20 ft unit being telescoped
Block & tackle
6 in
36 in gauge
T-headed jack to each rib

Placing Train Improves Concreting

MOBILE concrete placing train was designed by Robert S. Mayo, tunnel and mine equipment supplier, Lancaster, Pa., to cut segregation of mix and reduce air consumption which result from blowing concrete long distances.

Concrete, mixed on surface, is dropped down shaft through 6-in. pipe into small bin. Bin discharges into 3-cu yd hoppers mounted on flat-cars. Hopper cars dump into short, car-mounted belt conveyer feeding car-mounted gun. Belt and gun are on sidings slashed out of the drift at 1,000-ft intervals. Telescopic steel forms (lower right) mounted on flat cars are also used.

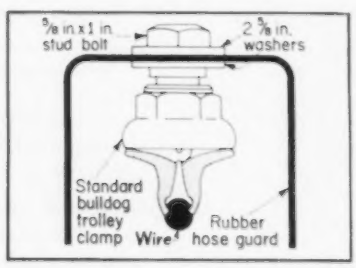
Tractors Speed and Ease Timbering

RUBBER-TIRED TRACTOR, fitted with a fork-lift-like swiveling cradle on end of hydraulic arms, speeds timbering at U.S. Potash Co., Carlsbad, N.M. Work platform is included between ends of arms.

To place stulls, timber is placed on forks and fastened down with rachet chain hoist on one fork. Arms are raised and timber tipped to vertical so timberman on platform can place wedges.

When cribbing, cradle is used as regular fork lift to raise timber to top of pile in horizontal position.

Units were adapted in mine's underground shop. Jack Hawn, timber faceboss, reports the attachment eliminates a lot of heavy work for the timber crew (who previously did all this by hand) and increases number of stulls and cribs set per shift, according to U.S. Potash's "Pioneer," monthly employee magazine.



Split Hose Makes Cheap and Simple Trolley Wire Guard

SPLIT RUBBER HOSE and other inexpensive parts serve effectively as a rugged mine trolley wire guard.

Installation is simple. Hose-guard is supported by the trolley wire and all that's needed to fasten the hose to the wire is one bolt, two washers, and a trolley wire clamp—all standard items in the average mine storeroom or shop.

In reporting the scheme, Ohio Brass Co.'s "Haulage Ways" magazine also adds: "Remember that how you put up trolley guards isn't as important as when you put them up—do it now!"

(*More Op Ideas on p. 186*)

DENVER ORE TESTING

Batch Testing—running a flotation test. 385 samples tested last year.

ASSURES MINE PROFITS ...ELIMINATES RISKS

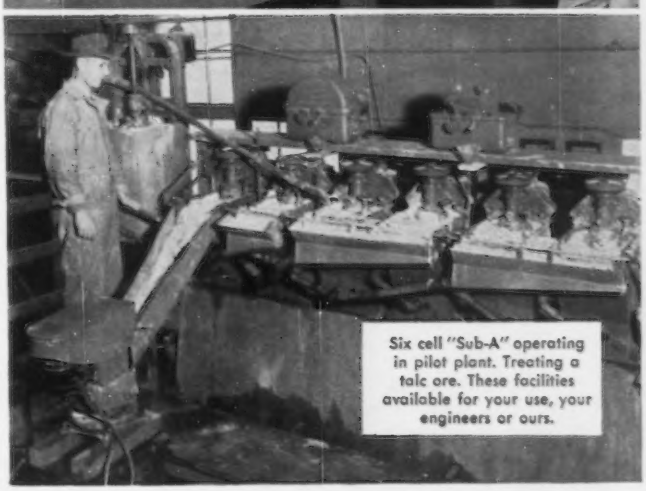
If you are building a new mill...or adding a new section...it will pay you to investigate the DECO "Better Way" of mill operation! Take the guesswork out of a big investment...and KNOW where you are going!

DECO engineers...with their many years of field, operating, design and laboratory experience...will test your ore...using the latest techniques and most modern equipment...and will inform you of the best and most economical way to process your ore.

Yes, it will pay you well to avail yourself of DECO's complete ORE TESTING services*...in time, money AND ore beneficiation!

*DECO's Ore Testing Division is operated as a non-profit service for the benefit of our customers.

Batch-Cyanidation testing—and determination of settling thickening rates.



Six cell "Sub-A" operating in pilot plant. Treating a talc ore. These facilities available for your use, your engineers or ours.

Clarence Thom heads the DECO Ore Testing Division and is but one of our many practical, experienced engineers who are ready and able to help you with your problems...TODAY!

"The firm that makes its friends happier, healthier and wealthier"

DECO ENGINEERS

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

DENVER EQUIPMENT CO.

1400 Seventeenth St. • Denver 17, Colorado

DENVER • NEW YORK • CHICAGO • VANCOUVER • TORONTO

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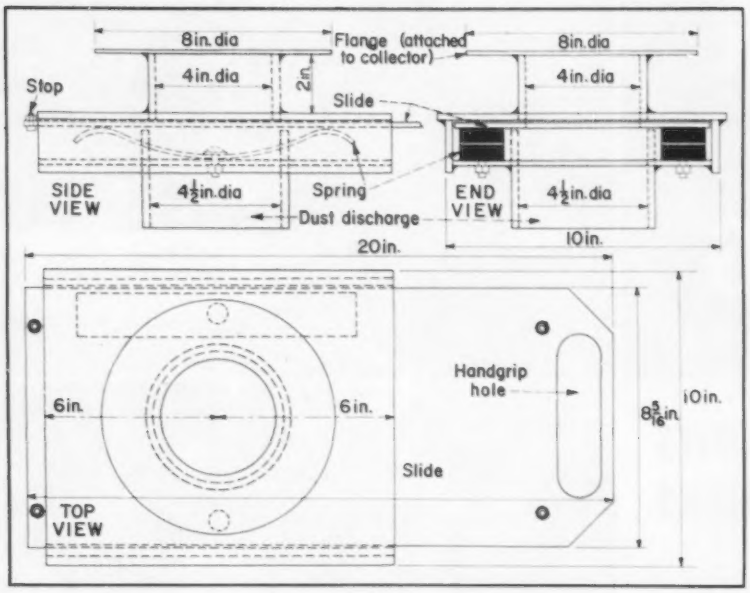


Dust Collector Gate Is Made Air-Tight

STIFF SPRINGS to hold the slide firmly against gate ceiling at all times are the outstanding features of a simple air-tight slide gate designed by C. N. Schuette, general manager, Sonoma Quicksilver Mines, Inc., Sonoma County, Calif.

Gate was installed on the dust discharge of a Sirocco dust collector handling quicksilver-laden gases generated in a 4x64-ft rotary kiln and enroute to the pipe condenser at the company's reduction works at Guerneville. Because of the tight seal, air is prevented from entering the collector system during gate's opening and closing. Entire unit was built at mine's repair shop from scrap material at low cost. Slide's traveling distance is controlled by stops.

Strap Welds Are Strong And Economical

"STRAP WELDING" has consistently offered an infinitely wider margin of safety—at the same time costing far less in time and materials, according to R. G. LeTourneau, president of R. G. LeTourneau, Inc., Longview, Texas.

Consisting of attaching one or more metal bars across a weld, strap welding has been criticized for not "looking too good." To this Mr. LeTourneau retorted: "Looks are a matter of education of the eyes—and my eyes like the looks of strap welds because I've seen so many strap welds take the gaff." He claimed that a ½-in. weld would be at least one-fourth as strong as one measuring 2-in., but would contain only one sixteenth as much metal and could be applied sixteen times faster. So, he said, in butt welding pieces of 2-in. plate, rather than weld entire 2-in. thickness, only weld ½-in. deep from each side (face) and then simply put on a few straps to make up for the center half. Used on the company's heavy equipment, these welds have been put under great degrees of punishment with practically no structural failure.

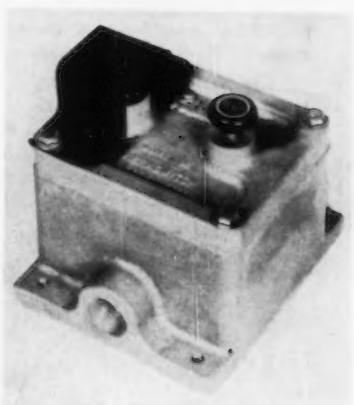
LeTourneau concluded with: "The secret of our success back in those early days was, and still is, that we don't have to depend on 100% strength welds. Sure you can make them, but it costs more and isn't really as safe as putting a strap on. As for myself, I prefer—taking no chances."

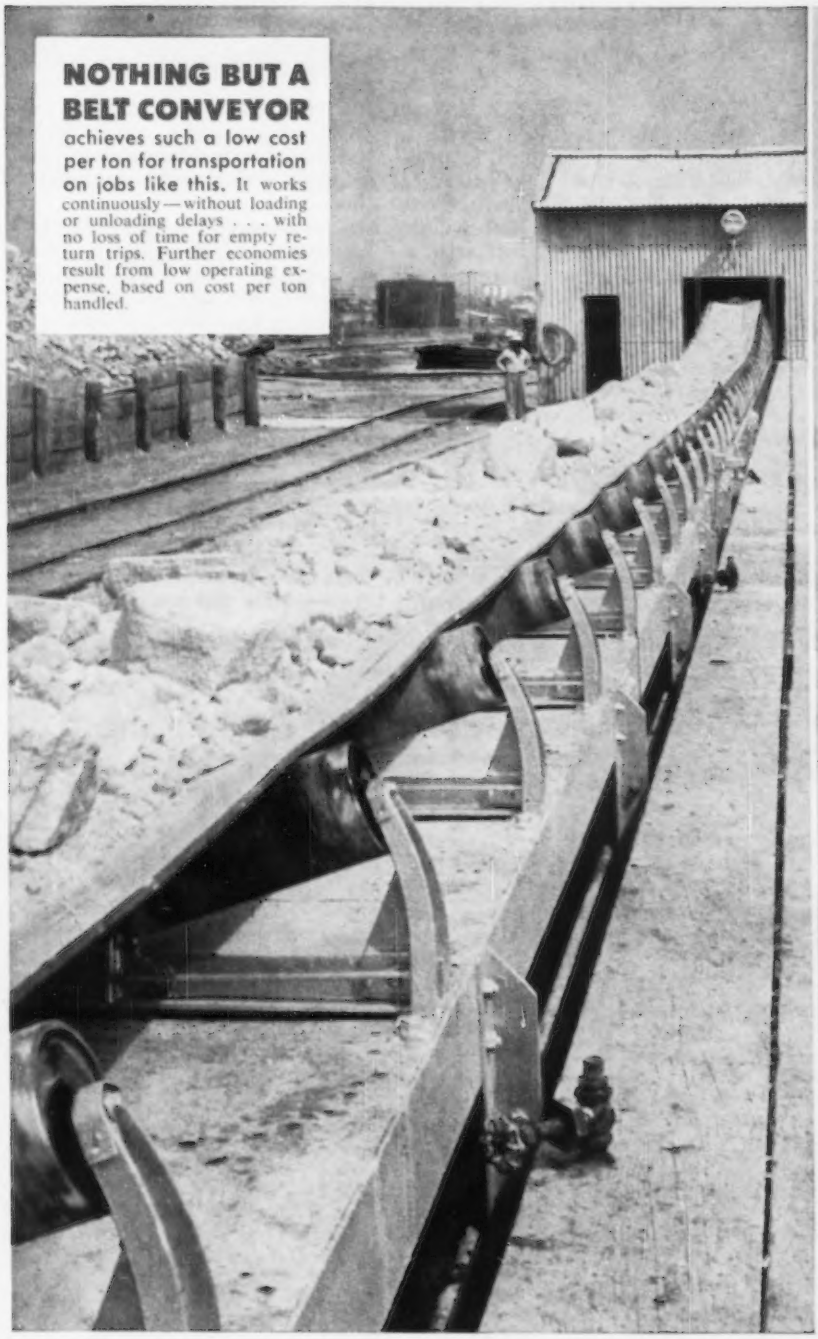
Switch Prevents Vibration Damage

NO DAMAGE to equipment or building resulted when a burlap sack wrapped around rotor of a high-speed, fine grinding centrifugal impact mill at Amveco C.A., Tinaquillo, Venezuela, asbestos mining subsidiary of World Commerce Corp. Damage was avoided by having unit equipped with a vibration safety control switch.

Three Centramils Series 40, made by Entoleter Div., Safety Industries Inc., New Haven, Conn., were recently installed for finer grinding of what were formerly classed as tailings. Finer grind frees very short fibers for custom mixes.

Since units were planned for continuous unattended operation, they were fitted with Vibraswitch model 65A-EP LS. Switch, made by Robertshaw-Fulton Co. for vibration levels above the 2G range, is also suitable for hazardous locations.





NOTHING BUT A BELT CONVEYOR

achieves such a low cost per ton for transportation on jobs like this. It works continuously—without loading or unloading delays . . . with no loss of time for empty return trips. Further economies result from low operating expense, based on cost per ton handled.

...AND NO ONE BUT LINK-BELT

offers such complete service for engineering belt conveyors. Calling on unequalled depth of experience, Link-Belt can do a quick but thorough job of analyzing your requirements . . . back up recommendations with a complete line of equipment.

OVERALL ENGINEERING

COMPLETE EQUIPMENT

SKILLED ERECTION

ASSURED SATISFACTORY PERFORMANCE

No wasting of engineering manhours on details . . . no need to exchange drawings with scattered suppliers with Link-Belt handling your belt conveyor installation. You get all equipment from one source . . . the specialization that only industry's most comprehensive line of idlers—plus pulleys, drives, terminal machinery and auxiliary equipment—can offer. From design through erection, Link-Belt takes on total responsibility. Our nearest office has full information.

14.760

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

ered spot-coolers near face in deep underground mines in South Africa; main ventilation fans mounted vertically were found superior at Inco; and a German chemical agent when introduced into ventilation air (few mg per cu meter), reputedly causes electrostatic coagulation of air-borne dust into non-hazardous, plus 10 micron particles.

Fighting a fire caused by a cutting torch in a 50-ft section of a cribbed raise was quickly and efficiently done with CO_2 gas and dry ice at Penokee iron mine in Michigan. CO_2 was carefully fed as gas from cylinders into compressed air line which was opened where it entered raise. After several hours, 300 lb of dry ice was dumped in from top. This resulted in explosion. Shortly after, another 1700 lb were dumped in and raise sealed for 24 hr.

Of 346 accidents in underground mines in Lake Superior district, analysis by USBM showed over 50% of men involved had worked 10 years or more in mining and over 70% had worked more than a year on particular job. In Ontario, analysis of accidents related to use of explosives during 1951-1956 shows 25% because of insufficient protection from flying debris or concussion, 29% because of missed holes (drilling into, cleaning out, scaling around) and 11% because of returning too soon. To ease finding missed holes, radioactive tracer was added to explosive and detector used. Results indicate scheme is not practical or economic now.

Training and selection of personnel gains momentum. Special films speed training of native miners in South Africa. Selection apparently is well perfected by West Virginia University psychology department—a number of coal companies seem to swear by it. Work simplification, cost control and employee-employer communication programs are getting increased emphasis at several western U. S. operations.

Mechanized accounting with punched cards is gaining a worldwide spread. This year installations were praised at mines in Minnesota, South Dakota, South Africa and Burma.

Research in mining has strong demand and interest, based on these clues: the pride with which mining companies exhibit their research departments; and increased attendance at symposia of special but limited scope. But one hitch in this view is the apparent apathy of U.S. companies to support a translating and abstracting service covering foreign mining literature that was proposed this year•

COPPER *(Continued)*

output in the U.S. of some copper using industries. He said a copper tariff in the U.S. would raise the copper price in the U.S. and reduce consumption.

U.S. Government purchases of copper in connection with its long term expansion contracts may do little to bouy the industry. Late in 1956 and early in 1957 it was taking about 5,000 tons per month. This copper was bought on flat price contracts it had entered into several years earlier. By the middle of 1957 most of these were running out. They were replaced by the Government's long term copper expansion contracts. San Manuel has a contract that probably covers about 5,000 or more tons per month. White Pine has a contract of about 3,000 or 3,500 tpm. The San Manuel base price is 24c a lb and with escalation may be worth about 27c a lb; the White Pine base is 25½c and may now be about 28½c. Falconbridge had such a contract, but with a base price of 19c. A little of the flat price copper may still be entering the Government stockpile. The total of the two forms of contract accounted for an estimated 87,000 short tons in 1957. Owing to an accumulation of copper destined for the stockpile, December shipments jumped to an estimated 17,500 tons. Most think it will average about 9 or 10,000 tons a month.

But this is well above 1956, when about 40,000 tons are estimated to have entered the stockpile. Strike losses in 1957 were about 40,000 tons; only about 5,000 of this was in the U.S. In 1956, strike losses were about 21,000 tons, of which 1,000 were in the U.S. Total strike losses in 1955 were about 144,000 tons with about 94,000 in the U.S•

Announcing the revolutionary

CASE® W-9 TERRALOAD'R

1⅜ to 2¾ cu. yd. capacity
Four-wheel-drive, rear-wheel steer

CASE

1st in quality for over 100 years

Empty weight on rear axle
9,020 lbs.

4-wheel-drive, rear-wheel
power-steer

Full power-shift in all speeds
plus forward and reverse

Empty weight on front axle
6,660 lbs.

Total weight—15,680 lbs.

11,000 lbs. break-out force

5,000 lbs. carrying capacity

Powerful high-torque Case gasoline or diesel engine, equipped with power-boosting torque-converter drive, gives the Case W-9 Terra-load'r up to 40,000 lbs.* of crowding power for fast digging in hard materials. Direct thrust design utilizes full power and prying action of machine for maximum digging efficiency. Operator always has clear view of bucket.

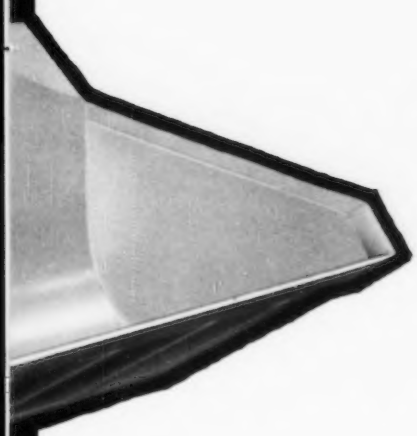
*Assuming adequate traction

40° bucket rollback, combined with properly balanced weight distribution, enables the Case W-9 to carry bigger payloads at higher speeds — with less spillage — and without the usual "bounce and forward-dip" experienced with conventional rubber-tired loaders. Full power steering on rear wheels makes unit extremely easy to turn and maneuver.

Short, rigid lift-arms, pivoted ahead of the operator, provide 62½" of forward reach for pitching loads into center of truck. This exclusive feature also gives operator unobstructed visibility on both sides . . . eliminates danger of catching operator's arm in lifting mechanism . . . makes it easy to get on or off machine any time, without climbing over boom arms.

NEW CASE® W-9 TERRALOAD'R

revolutionizes loader performance on rubber ...saves you up to $2000 in first cost!



Here, at last, is a big capacity *4-wheel drive, rear-wheel-steer* loader that gives you all the advanced performance features you've been wanting in this type of unit — at savings *up to $2000 in first cost.* With the new W-9 Terraload'r you get . . .

Better balance and stability — Improved weight distribution, with 37% more empty weight on rear wheels, provides better traction for tough digging, without "bucking", or raising rear wheels off ground. This, together with better lateral stability, enables you to dig, maneuver and dump heaping payloads faster, easier, more safely.

Improved operator safety — Operator has unobstructed visibility in all directions . . . can get on or off machine in a hurry. And all boom-lifting mechanisms are completely out of the way!

Power matched to the job — High-torque Case gasoline engine (or famous all-weather-starting Case diesel), with torque-converter drive, insures adequate power for all digging and loading operations — with *maximum* fuel economy, dependability and long life.

Constant-mesh power-shift transmission — Provides three forward and reverse speed ranges — from 0 to 21 MPH — automatically balanced to changing loads, with full power-shift on-the-go in all speed ranges, as well as forward and reverse. Two conveniently located levers — one for speed selection, one for forward and reverse — give instant, positive control without mechanical shifting.

One warranty, one service source — Complete machine — *including the engine* — is engineered, built and fully warranted by J. I. Case Company, and serviced by reliable Case Industrial Dealers everywhere. No costly delays on parts! No "split-responsibility" on service!

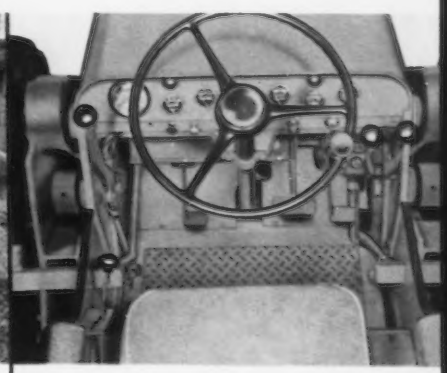
Investigate today — Call or write your nearest Case Industrial Dealer for full information, including details of new Case financing and LEASE plans to fit your needs, without tying up needed working capital.

3 Bucket Sizes

1⅜ cu. yd.—for tough digging
1¾ cu. yd.—for std. materials
2¾ cu. yd.—for light materials

Big 42.5 GPM hydraulic pump teams with husky double-acting lift and bucket-tilt cylinders to give the Case W-9 Terraload'r a terrific break-out force of 11,000 lbs. at ground level. Carrying capacity in travel position is 5,000 lbs. All-weather cab (shown in above illustration), together with heater and other deluxe accessories, are optional at extra cost.

Wide, flat-bottom Case bucket gets heaped loads fast . . . raises to full lift-height in 7½ seconds. Automatic sight-leveling gauge on right bucket tilt-cylinder tells bucket-angle at a glance, enables operator to adjust bucket to ground level position while lowering. Transmission is automatically disengaged by touching brake, for max. hydraulic power.



Operator rides in a comfortable air-controlled seat, fully adjustable fore and aft, with all controls within easy reach. Readable-at-a-glance instruments are color-coded for proper operating range. Two handy foot throttles — one on right side for normal operation and one on left — make it easy to "gun" engine with left foot, while right foot operates brakes.

You get better visibility ...more side stability with

NEW CASE® W-9

Note the clear view ahead from the operator's position in the Case W-9 Terraload'r. No dangerous "blind-spots" from massive yokes or bucket linkage. You also get much better side stability due to the W-9's *low center of gravity and wide wheel tread.* These exclusive features, together with shorter, more rigid lift arms — pivoted *ahead* of the operator's compartment — enable you to *maneuver bigger loads faster, easier* — without the usual "swing and sway" encountered with other 4-wheel-drive loaders.

Add the advantages of longer forward reach, plus *improved "fore and aft" stability,* and you'll quickly see why the new Case W-9 is already being acclaimed as the *safest, easiest-handling 4-wheel-drive loader in its capacity range.* Call your nearest Case Industrial Dealer today for the complete story, including details of new Case financing and LEASE plans, with easy monthly payments, tailored to fit your needs.

Investigate this new Case-built, Case-powered Terraload'r today

Long-term lease or purchase plans to fit your needs

Ask your nearest Case Industrial Dealer to show you how you can LEASE the new W-9 Terraload'r — as well as other Case® TerraTrac® industrial wheel and crawler units — *on easy monthly rental terms* — WITHOUT tying up needed capital. Your Case lease contract may also contain an *"option to purchase"* at any time, with all prior rental payments credited on purchase price. Investigate today!

Clip...mail for free catalog

J. I. CASE COMPANY, Racine, Wis., U.S.A.

☐ Send free catalog on new W-9 Terraload'r

☐ Send name of nearest Case Industrial Dealer

Name ..... Title .....

Employed by .....

Address .....

City ..... State .....

C-TL-138

CASE 1st in quality for over 100 years

Brief W-9 Specifications

LOADER

Bucket capacity (heaped)	1⅜, 1¾ and 2¾ cu. yds.
Break-out force	11,000 lbs.
Carrying capacity	5,000 lbs.
Rollback at carry	40°
Forward reach (at 7' dump)	62½"

TRACTOR

Gross engine HP (Gasoline)	69.5
Gross engine HP (Diesel)	65.7
Axles	Spiral bevel with planetary reduction in hub
Torque converter	Single Stage — 3.5 to 1 Stall ratio
Transmission	Full power-shift, 3 speeds forward and reverse
Max. lbs. push or pull (Fwd. or reverse)	
1st	40,000
2nd	11,500
3rd	4,970

Assuming adequate traction, the torque converter automatically adjusts drawbar pull or push to the above loads within following speed ranges:

	Forward	Reverse
1st	0 to 2.4	0 to 2.4
2nd	0 to 6.5	0 to 6.5
3rd	0 to 21.0	0 to 21.0

Tires (4) Standard	14.00 x 24 — 8-Ply tubeless
Overall length at carry	18'3"
Overall width (over hub)	93"
Approx. weight	15,680 lbs.

Litho in U.S.A.

C-TL-133

"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."

G. F. Franz
President

Grinding Mill Bulletin #1

CF&I is firmly convinced of the value—to us as well as to our customers—of our president's words, quoted above. In line with this principle, we are now commencing a series of ads designed to add important technical facts to the mining industry's store of knowledge on more efficient grinding mill operations. We have purposely restricted the subject matter of these ads so that they will be of interest to only one segment of the readers of this magazine—grinding mill operators. And this is right in line with CF&I's policy—"*not merely to sell; but to serve.*"

Grinding Ball Rationing of the Makeup Charge

A practical means of improving many grinding mill operations is to determine the optimum size assortment of grinding balls that should be added as a makeup charge.

Increased Milling Throughput Reduces Milling Cost

Total milling cost will *decrease* as number of tons processed (throughput) *increases*. This advantage can be realized in any plant, provided that the rate of mining and all steps in ore processing can be increased to match the greater throughput of the ball mill, which makeup charge rationing makes possible.

Indications That Rationed Charge Is Needed

When a one-size ball addition to a mill is being established, the following conditions may indicate that ball rationing is warranted:

1) There may be a certain amount of tramp oversize that can be reduced by replacing a portion of the balls by a larger size.
2) There may be a crowding of particles of reduced size but not of finished size, showing a deficiency of small-size balls.

When a new mill is started up, time is needed to get the process running smoothly. To add a further problem of determining a makeup ration during this start-up period would be ill-timed.

Ball Wear Pattern

When balls of one size are used for addition, the seasoned charge in the mill ranges from balls of the original diameter to those small enough to purge from the mill. If a screen analysis of the ball charge is made using screens with openings of equal increments, such as ½ inch, the weight of the balls on each screen will show a certain pattern or distribution of the charge by weight. Apparently the rate of wear of different ball sizes in the charge is affected by the size structure of the mill feed and by the crystal size of the minerals. Also, the physical and metallurgical characteristics of the ball may vary with the distance from its center.

There is evidence that there is a difference in the wear pattern of grinding balls of different manufacture. Some appear to be *self-rationing* while others do not. This self-rationing quality, the built-in ability to wear evenly and give longest possible service life, is an important feature of CF&I Forged Steel Grinding Balls. Proper analysis steel, and continuous control and inspection at every stage of production help CF&I to impart this self-rationing quality to its grinding balls.

Impact, Nipping and Attrition Grinding

Large balls in the charge drop with greater impact and also have a more effective nipping action on the larger particles. Small balls make a greater number of contacts (since there are more of them), so that attrition grinding is more effective. Fine crushing is increased due to greater nipping action incidence on the small particles. Ball rationing is employed to change the size distribution of the ball charge to one that has a better ratio of impact, nipping and attrition.

Not All Mills Should Attempt Ball Rationing

Most small mills, and some of the larger ones, do not have the facilities to blend mine run ore for mill feed. With a great variation in character of feed, establishing even an optimum single-size ball charge may be a difficult problem. Facilities, personnel, and sufficient time may not be available for careful testing. The cost of such an effort may not be justified. Total savings in dollars and cents, through a relatively minor improvement in grinding practice, will not be as great in a small operation as in a larger one. Nevertheless, it appears obvious that, for many operations, the attaining of an ideal ball ration can increase the efficiency of milling sufficiently to warrant the effort involved in its development. Other pertinent factors will be discussed later in this series.

For a reprint of the article on which this ad is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P. O. Box 1920, Denver, Colorado.

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

CF&I Grinding Rods · CF&I Grader Blades · CF&I Industrial Screens
CF&I Mine Rail and Accessories · Wickwire Rope · CF&I Rock Bolts

FORGED STEEL GRINDING BALLS
THE COLORADO FUEL AND IRON CORPORATION
5822

Albuquerque · Amarillo · Atlanta · Billings · Boise · Boston · Buffalo · Butte · Chicago · Denver · Detroit · El Paso · Ft. Worth · Houston
Kansas City · Lincoln (Neb.) · Los Angeles · New Orleans · New York · Oakland · Oklahoma City · Philadelphia · Phoenix · Portland
Pueblo · Salt Lake City · San Francisco · San Leandro · Seattle · Spokane · Wichita

PERSONALS

Lawson

Kuzell

Walter C. Lawson, formerly general manager of Phelps Dodge Corp. in the West, succeeds **Charles R. Kuzell,** who retired Feb. 1, as vice president in charge of its Western activities. Mr. Lawson, of Douglas, Ariz., was also elected a director of the corporation at a recent board meeting. He is a mining engineer with long experience in the management of the Phelps Dodge properties in Arizona. In 1952, after service as general superintendent of its Morenci branch and as manager of its New Cornelia branch, he was made assistant to Harry M. Lavender, then vice president in charge of Western operations. He became general manager in 1955.

George E. Morris, superintendent of Chile Exploration Co.'s copper smelter at Chuquicamata since 1951, has been named director of metallurgy, Cananea Consolidated Copper Co., S. A. He will be located at the company's headquarters at Cananea, Sonora, Mex. A graduate of the University of Illinois, Mr. Morris commenced his service with the Anaconda organization at the Great Falls, Mont. refinery in 1925, and since 1928 has held various supervisory posts at plants at both Potrerillos and Chuquicamata, Chile.

Morris

Dr. B. D. Thomas, scientist and research administrator, has been named president of Battelle Memorial Institute to succeed Dr. Clyde Williams, who retired recently. Active head of Battelle since being named director a year ago, Dr. Thomas has been a member of Battelle for many years. He joined the staff as a research engineer in 1934, was appointed assistant director in 1942, and vice president in July 1955.

Thomas

Dr. Norman A. Spector, vice president of Vitro Corp. of America, will, in addition, become president of the recently formed Vitro International, an operating company with headquarters in Switzerland. He will retire as vice president of Vitro Engineering, a Vitro operating company, to devote full time to the new duties. **Ralph L. Brown,** former assistant sales manager of Vitro Engineering Co., will become vice president of the overseas company.

Anaconda Co. announced the appointments, effective Jan. 1, of **Norbert F. Koepel** as assistant to the vice president of both Chile Exploration Co. and Andes Copper Mining Co.; **Glen S. Wyman** as general manager of same; and **Robert C. Becker** as resident manager of Chile Exploration Co. at Chuquicamata, Chile.

AIME has elected three eminent engineers to receive honorary membership: **Dr. Champion Herbert Mathewson,** professor emeritus of metallurgy and metallography at Yale University since 1950 and former president of AIME; **Donald Hamilton McLaughlin,** of San Francisco, president of Homestake Mining Co.; and **Fred Searls, Jr.,** of New York, chairman of the board of Newmont Mining Corp. Other awards: William Saunders gold medal to go to **William J. Coulter** "for . . . success of Climax Molybdenum Co., and . . . developing mining practices of Climax mine." The J. E. Johnson Jr., to **Richard H. White;** Robert W. Hunt medal to **George W. Healy** and **Donald C. Hilty;** Rossiter W. Raymond Memorial Award to **Richard J. Charles.**

Robert O'Brian, mining engineer, was appointed manager of Southern Illinois Mining Co., and **B. J. Squire,** of Arizona, has joined the engineering staff.

Ben B. Yoffee, of Jacksonville, Fla., is the new president of Apex Minerals Corp. **J. H. Clasgens,** of New Richmond, O., is a director.

George C. Lipsey, former vice president of Britannia Mining & Smelting Co. Ltd., has been elected president of the Association of Professional Engineers of B. C.

F. S. Mulock, president of United States Smelting, Refining & Mining Co., has been named chairman of the board of United States Fuel Co. **Oscar A. Glaeser,** vice president of USSR&M, was named president.

H. Z. Stuart has been appointed manager of exploration for Phelps Dodge Corp. He had been resident engineer of mines for Phelps Dodge in New York. The new appointment shifts to New York the corporation headquarters for exploration activities, which were heretofore directed from Douglas, Ariz. The Douglas exploration office will remain active. Mr. Stuart's responsibility will also include the direction of exploration activities of the corporation's Canadian subsidiary, Phelps Dodge Corp. of Canada, Ltd., at Toronto.

Daniel P. Eigo has been named managing editor of *Engineering and Mining Journal* effective Jan. 1. He succeeds George P. Lutjen, who has accepted a new post with McGraw-Hill. Mr. Eigo joined *E&MJ*'s staff in 1953 as copy editor, and in 1955 was promoted to news editor and to associate editor in 1957. He is a graduate of the New York University School of Journalism. Prior to coming to *E&MJ*, he served for four years as assistant editor on an up-state New York newspaper, and during World War II he served with the Navy in the South Pacific. He has visited mines in the West and Southwest, and in Canada and the Eastern states since joining *E&MJ*, and is an associate member of AIME.

Eigo

Leonard L. Slabodnik has been appointed purchasing agent for U. S. Steel's Oliver Iron Mining division, succeeding G. A. Engel, who had retired.

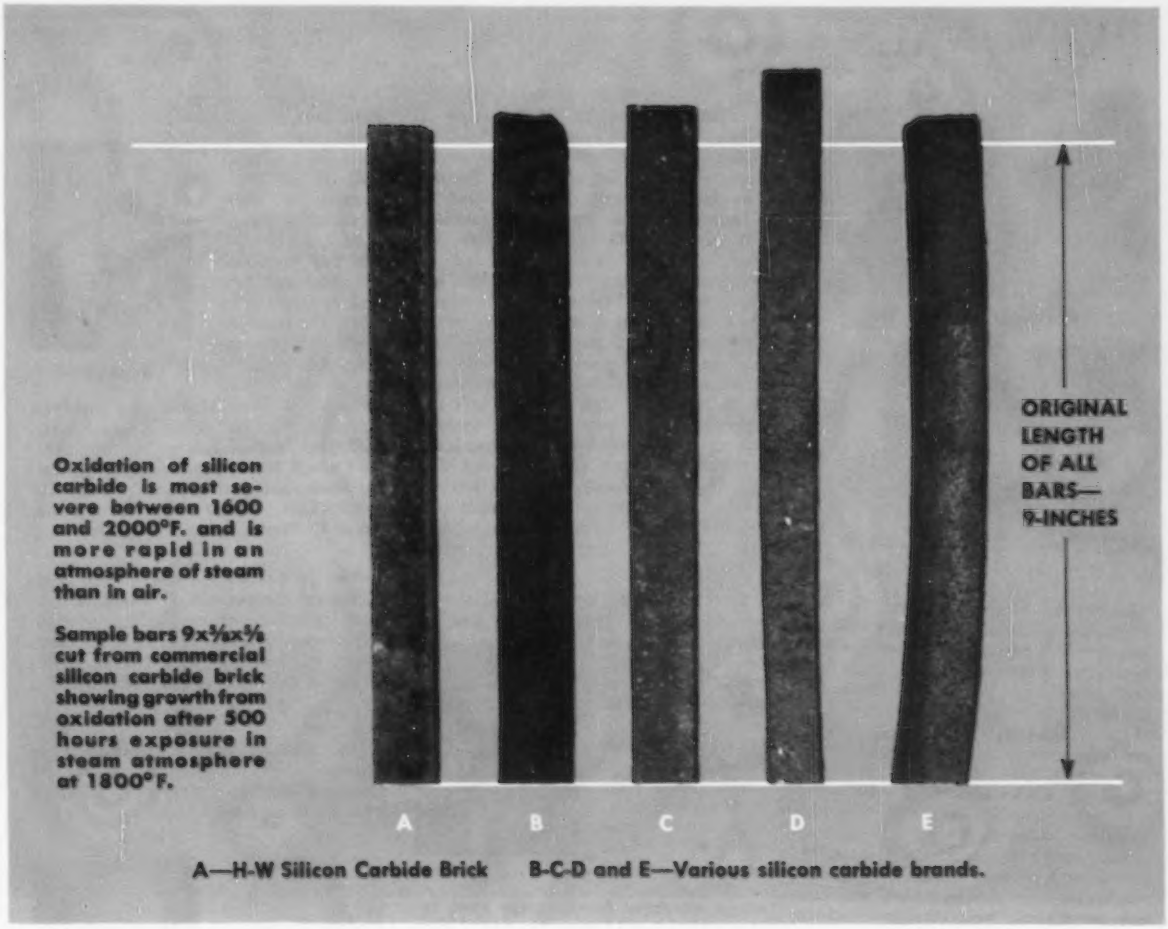
Sali Hochschild, president and principal shareholder in Compañia Mineral y Comercial Sali Hochschild Ltda., was awarded the Institute of Chilean Mining Engineers' gold medal, for long and distinguished services to the Chilean mining industry during nearly 50 years of active and successful work in that country. Señor Hochschild, who is a Columbia University graduate, was presented with the award by Señora Hochschild at a large banquet in La Serena, Chile, where the Institute held its Eleventh Convention.

Hochschild

L. R. Payton heads the newly established Rigid Container Division of Reynolds Metals Co., to plan marketing of aluminum containers and to set up a research program to determine their potential. Mr. Payton, formerly manager of Reynolds' Bellwood smelting plant in Virginia, will be headquartered at the firm's corporate headquarters there. A graduate of Princeton University, he joined the company in 1946.

Payton

Glen A. Boyd will transfer from St. Paul to the newly opened Seattle office of Northern Pacific Railway Co.'s geology division, according to announcement made by Donald W. Lindgren, NP's chief mining geologist.


Oxidation of silicon carbide is most severe between 1600 and 2000°F. and is more rapid in an atmosphere of steam than in air.
Sample bars 9x⅞x⅝ cut from commercial silicon carbide brick showing growth from oxidation after 500 hours exposure in steam atmosphere at 1800°F.
ORIGINAL LENGTH OF ALL BARS— 9-INCHES
A
B
C
D
E
A—H-W Silicon Carbide Brick
B-C-D and E—Various silicon carbide brands.

Announcing

Silicon Carbide Refractories

made by HARBISON-WALKER

Some of the physical properties of major importance are measurably enhanced by developments in manufacturing procedures. Many sizes and shapes are formed by impact under great pressure resulting in the most homogeneous texture with higher density and strength.

High temperature firing in a closely controlled atmosphere contributes to the formation of an exceedingly impervious surface and lower permeability. These properties improve resistance to the objectionable oxidation which always is accompanied by volume increase and loss in strength.

Physical properties possessed to the *maximum degree* by H-W Silicon Carbide refractories make them best suited for many applications. Briefly these properties are—Thermal Conductivity—Resistance to Mechanical Abrasion over a wide range of temperatures—Resistance to various fluxes—High temperature strength—Low Thermal Expansion and Low Spalling Tendency.

Write for recommendations and technical assistance.

World's Most Complete Refractories Service

HARBISON-WALKER REFRACTORIES COMPANY
AND SUBSIDIARIES
General Offices: **Pittsburgh 22, Pennsylvania**

PERSONALS *(Continued)*

Ferris

Steen

Romney

Glaeser

Charles A. Steen, president of Utex Exploration Co. and vice president and director of Uranium Reduction Co., has been elected president of the Utah Mining Association for 1958, succeeding Clark L. Wilson, of Salt Lake City. **Oscar A. Glaeser,** vice president of western operations, United States Smelting & Refining Co., is the new first vice president. **Lockwood W. Ferris,** president of Bonneville Ltd. is second vice president. **Miles P. Romney** is retained as secretary-manager, with **Walter M. Horne** as assistant manager. **O. G. Mackenzie** was renamed vice president and consultant. New directors include **Arthur McQuiddy, J. M. Ehrhorn, A. M. Mastrovich, Gordon Miner, Ralph W. Neyman, J. F. Frost,** and **W. J. McKenna.**

John H. Jett, acting general manager since Oct. 1, 1956, has been appointed vice president and general manager of Vulcan Iron Works Co., Denver, Colo. **C. W. Hawn,** a member of AIME, recently joined Vulcan's staff as sales engineer.

Martin Eichelberger, geophysicist, recently with Geophysical Service, Inc., has joined Aero Service Corp., Philadelphia, worldwide aerial mapping and exploration company, as a representative of the Airborne Geophysics division. Eichelberger brings a background of 19 years' exploration experience with the oil industry. He has spent 11 years on foreign assignments, and was previously with United Geophysical Corp. and with Magnolia Petroleum Corp. A graduate of UCLA, he completed two years of graduate work in geophysics at Caltech before entering field work.

Eichelberger

Organization changes at New Jersey Zinc Co., effective Jan. 1, 1958, are: **W. L. Albers,** formerly superintendent of the Austinville operation, is now general superintendent for Virginia. **Johnson Crawford,** formerly superintendent for Tennessee, is now general superintendent for Tennessee. **C. G. Morgenstern,** formerly assistant superintendent of the Austinville operation, will be the new superintendent, replacing Mr. Albers. **R. E. Radabaugh,** formerly assistant to the western manager of mines, is now assistant manager of exploration, with headquarters at Grand Junction, Colo. **F. H. Main,** formerly assistant to superintendent of Tennessee, will be assistant manager of exploration, with headquarters in New York City. Effective Feb. 1, 1958, **J. I. Craig,** formerly superintendent of the Hanover, N. M. operation, assumed post of superintendent of Flat Gap, Tenn. operation.

Vinton H. Clarke, who resigned as vice president in charge of mining and exploration of Howe Sound Co., has joined the mining, geological and metallurgical consulting firm of Behre, Dolbear & Co., Inc., New York City. Announcement was made by E. Cecil Roper, president of Howe Sound, whose executive headquarters have recently been moved from New York City to Salt Lake City, Utah. Mr. Clarke, with Howe Sound for over 20 years, contributed to the development of its mining activities. He is a member of Canadian Institute of Mining and the AIME.

Clarke

Frank J. Wiebelt, formerly of Reno, Nev., now a resident of Arizona, who retired recently as a U. S. Bureau of Mines mining engineer, has been honored with the Commendable Service Award and Bronze Medal of the U. S. Department of the Interior. He made noteworthy contributions to the Bureau's exploration for manganese, which resulted in development of domestic manganese deposits to aid steel production during World War II. His publications on results of his investigations gave valuable information on strategic and critical mineral resources in Nevada, California and Washington.

Hugh W. Halton and **Ralph H. Cutler Jr.** were elected as assistant vice presidents of C. Tennant, Sons & Co., of New York, effective Jan. 1, 1958. Mr. Halton has been with the company since 1940 in the capacities of vice president of the Sink & Float Corp., and resident engineer. Mr. Cutler, with the company since 1947, will be in charge of its Ores and Concentrates department.

Pharic D. I. Honeyman, of Inspiration, Ariz., was recently elected president of Inspiration Consolidated Copper Co. at a board meeting in New York. Mr. Honeyman is a director, and has been vice president and general manager since 1947. He succeeds Richard S. Newlin who has resigned as president and director. **William Wraith Jr.** has been elected a director. Other changes were: **H. Myles Jacob,** executive vice president; **H. Carroll Weed,** general manager; **Carl G. Stunz,** assistant general manager of Inspiration's Arizona operations; **Edward F. Wendt,** secretary-treasurer.

Honeyman

Robert D. Ferron has now retired from Kennecott Copper Corp., where he had been in charge of the South American Exploration Department. He has established residence in Los Gatos, Calif., where he will be available for consulting work.

E. A. Schroer, mill superintendent of Chino Mines division of Kennecott Copper Corp., retired Jan. 1, 35 years after he first joined Chino.

Kennedy

Glass

Herbert M. Weed has been elected vice president of Anaconda Sales Co. and Anaconda Export Co. effective Jan. 1, 1958. Other executive changes announced by the Anaconda Co. subsidiaries were the retirements of **W. E. Kennedy** as executive vice president, **Clarrence Glass** as vice president and **John A. O'Brien** as assistant secretary, effective Dec. 31, 1957. Mr. Weed joined Anaconda in 1948, prior to which he had been with American Brass Co. and also served in the U. S. Naval Supply Corps. He is a member of the Mining Club and various professional and mining societies.

Weed

T. M. Hipp is manager of Phillips Petroleum Co.'s newly formed mining and milling department.

These High Strength Steel trailers were built by the Marion Metal Products Company, Marion, Ohio. Use of 12-gage **USS Cor-Ten** Steel, instead of 10-gage carbon steel, reduced weight 23%.

High Strength Steel trailers increase payloads 50%

at Saxton Coal Corporation, Petersburg, Indiana

When Saxton Coal Corporation moved their strip mine location, the dump trucks had to travel twice as far to unload at the transfer tipple. To maintain their daily loading schedule they had to build a bigger fleet, or increase the payload of the trucks they were using—without going over the legal weight limit. Part of the route was on state highways.

They decided against more trucks and additional operating expenses, and solved their problem by purchasing High Strength Steel trailers that could be handled by their present tractors. "We increased the payload of each truck more than 50%," says General Manager Darwin C. Youngs, "and we haven't exceeded the legal weight limit on the roads we travel."

Payload is increased with High Strength Steel construction because High Strength Steel is much stronger than carbon steel. Trucks and trailers can be made lighter, and *the weight saved goes into the load instead of the carrier.*

High Strength Steel has greater resistance to atmospheric corrosion, impact and wear than structural carbon steel. It needs less maintenance and it lasts much longer.

United States Steel produces three brands of High Strength Steel—COR-TEN, MAN-TEN and TRI-TEN. Each has its own characteristics that make it ideal for certain applications in trucks and trailers. USS "T-1" Constructional Alloy and USS Stainless Steels are also available. If you want more information about how these steels can help your trucking operations, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS HIGH STRENGTH STEELS

USS COR-TEN, MAN-TEN, TRI-TEN

USS, COR-TEN, MAN-TEN, TRI-TEN and "T-1" are registered trademarks of United States Steel

UNITED STATES STEEL

GOLD (*Continued from p. 130*)

"parallel" franc. In Hong-Kong, the U. S. dollar equivalent of the bar gold price, which had begun to rise in mid-1955 and had reached the equivalent of $38.50 in late 1956 (the highest since 1952), fluctuated close to that level during last year. In Bombay, the price of bullion rose from $58.20 in December 1956 to $60.50 in August, the highest since 1952; this compared with $52.00 in December 1955. Gold coin quotations, which—in countries with domestic gold markets—are usually one of the most sensitive indicators of public sentiment, fluctuated widely in a number of markets, with the general trend upward. In Paris, for instance, the dollar equivalent per fine ounce of the Napoleon was as high as $48.60 in July, as compared with $45.65 at the end of 1956 and $36.70 in June 1955, the lowest in recent years; it was $45.50 at the end of the year. In terms of French francs, the Napoleon was as high as 4,340 francs in mid-November (it stood at 4,000 at the year-end), as compared with 2,500 in June 1955. Great care, of course, must be taken not to read too much into the high gold prices prevailing in markets like Paris or Bombay. They are quoted in local, inconvertible currencies, and whenever they are converted into U. S. dollars, they are merely computed figures arrived at by converting the local currency price into dollars at exchange rates that are not necessarily realistic. Gold premiums also reflect the cost of overcoming the hurdles that impede the private flow of gold. Even more important, they reflect the monetary habits of the population, the efficiency and the stability of the local monetary system and of government finances, as well as the varying political prospects. In their very essence, premium gold prices are therefore a reflection of local conditions in the country concerned.

Among the restrictions on gold trading that were relaxed in 1957, the most important were the steps taken in the Federal Republic of Germany to virtually free the trade in gold—after 26 years of controls. The internal gold market had already been reopened in 1954, and the import of gold coins had been freed in 1956; in April 1957 the import of gold bars was freed on condition that such gold be imported by German residents from countries affiliated with the European Payments Union and that payment be made in the so-called "German marks of limited convertibility." Industrial users and dealers may, however, purchase gold against dollars. Exports of gold still require permits.

These German measures, together with the establishment of free markets in Belgium-Luxembourg and Canada in 1956, do not appear to have noticeably affected the earlier pattern of the international trading in gold. Nor does the freeing of the gold markets and trading seem to have increased the proportion of newly-mined gold that flows into private hoards. The various arrangements regarding domestic trading in gold reflect, of course, the particular needs of the countries concerned at any particular time; they do not in any way impair the principle that gold should, to the maximum extent practicable, be channeled to, and held in, official reserves where it will readily serve monetary purposes.

Monetary gold reserves of the central banks and governments and international financial institutions continued to grow throughout 1957, principally as a result of accretions of newly-mined gold. In September 1957, they stood at about $39,070-million (excluding the USSR), or about $630-million more than a year earlier. Of the September 1957 total, the U. S. held $22,759-million ($727-million above September 1956; the U. S. stock rose by a further $98-million during October-December 1957, and stood at the year-end at $22,857-million). Other countries, together with the Bank for International Settlements and the European Payments Union, held about $15,145-million ($448-million above September 1956); and the International Monetary Fund $1,167-million ($544-million below September 1956). In September 1957, the United States consequently held some 58% of the world monetary gold stock (as against 57% in September 1956, and 70% in September 1949).

Besides gold, foreign countries in September 1957 held about $14,527-million in the form of dollars, on both official and private account (including primarily deposits in U. S. banks and short-term United States Government securities as well as certain longer term United States securities), or about $150-million more than a year previous. Total gold and dollar holdings of foreign countries in September 1957 amounted to $29,672-million, or $594-million more than a year earlier. Had it not been, however, for the drawings by a number of foreign countries on the International Monetary Fund, which totaled $1,395-million during the year ended September 1957, the foreign gold and dollar holdings would have declined considerably. The build-up of foreign gold and dollar holdings that had begun in 1952 and averaged nearly $2-billion in each of the years 1953-1956, therefore came to an end last year (see chart III).

For the first time since 1952, foreign countries lost gold and dollars to the U. S. From October 1956 through September 1957 the rest of the world transferred $900-million to the U. S., according to the balance-of-payments data. As the year passed, however, there were indications that net transfers of gold and dollars by foreign countries to the U. S. slowed down; last year's loss was nevertheless in sharp contrast with the gold and dollar acquisitions of $1.0-billion to $2-billion annually during the preceding four years.

Gold and dollar losses by foreign countries were not, however, a consequence of any decline in payments from the U. S. for imports of goods and services or because of investment abroad and foreign aid. On the contrary, such payments rose still higher in 1957—for the fourth successive year. Merchandise imports, even though they stopped increasing, were higher than in 1956 (in volume as well as in value) and new outlays for investment abroad exceeded those of 1956; spending by American tourists abroad was strong; payments by U. S. military forces abroad continued at earlier levels; and U. S. foreign aid, military and economic, increased. For these (and other) reasons, U. S. performance with respect to its economic and financial relationships with the rest of the world was clearly good last year.

The shift in the international gold and dollar flows and the attendant losses of reserves by foreign countries to the U. S. thus resulted from developments in the foreign countries themselves. Among these developments, the most significant were the heavy foreign purchases of goods in the U. S. and, to an extent that cannot of course be determined with any accuracy, the inflow of short-term funds into that country.

U. S. merchandise exports (excluding those financed under the military aid programs) were 22% higher during the first half of 1957 than a year earlier. The rise in exports was attributable, in part, to several special or temporary factors—increased shipments of oil because of the Suez crisis, of cotton because of the selling for export at prices below the domestic level, and of wheat because of poor crops in a number of countries in Europe and Asia. Basically, however, it was the growing demand for American machinery, vehicles, chemicals, coal, metals, and manufactures, that

No. 2 in a series

Right off the Wire

A double submarine cable, 2400 miles long, gives direct telephone service between California and Honolulu. It reaches ocean depths up to 3½ miles. Simplex manufactured 60% of the cable.

Dissimilar, non-ferrous metals, including aluminum, copper, magnesium, titanium, brass, zinc, silver and gold can now be bonded by a new ion-exchange process.

Doppler radar, installed in aircraft, is being tested by commercial transport planes. If satisfactory, it is expected to have far-reaching effects on civilian navigation.

By using a 3800-gallon bag of rubber-coated rayon to contain liquids, a truck trailer can now serve a double purpose. Various linings make the bags suitable for corrosive or edible liquids. It is planned to make them in larger sizes for barges or storage.

A new pencil feeds lead automatically to maintain the correct writing length.

A new low-temperature laboratory is equipped to produce fifty quarts an hour of liquid hydrogen at −423°F. and eight quarts an hour of liquid helium at −453°F.

A color-video tape recorder-player has been announced.

A new off-shore drilling platform is able to operate in 600 feet of water. Present equipment is limited to about 100 feet.

A model of an ion-propelled rocket has been exhibited. Theoretically it should have an efficiency of 90 per cent and a speed of 25,000 miles per hour. Power would be derived from a nuclear reactor.

A mechanical construction kit for adult tinkerers contains 5,000 parts. It is claimed that a working model of almost any machine can be built with it.

One of the new European cars has three headlights mounted side-by-side behind a screen of curved glass. The middle lamp is pivoted and turns with the wheels.

A single drop of a new adhesive, used to join two pieces of metal, has supported a load of 5,000 pounds.

Paint that changes color at high temperatures is being used in oil refineries as a safety measure.

Man-made lightning, to test insulated cable, is produced by the new 1,400,000-volt impulse generator in the Simplex research laboratories.

A new fuel for jet and ramjet engines has a boron-hydrogen base and should increase the range of aircraft using it by forty per cent.

A new kind of "electric eye" uses radiation from a small amount of strontium-90 instead of an electric light. It requires no power supply and is not subject to interference from dust or smoke.

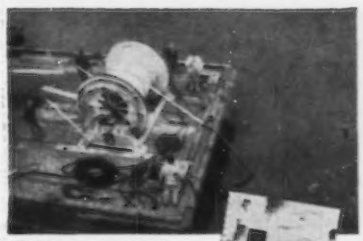
A twenty-five acre business center, being built in Venezuela, is in the form of a helicoid. It will be 365 feet high and access will be by a spiral ramp. At the top will be a 170-foot aluminum dome housing an exhibition hall and television station.

A generator has been designed that produces electric power directly from the chemical reaction of hydrogen and oxygen.

Since 1950, over 4000 miles of cable protected by Simplex C-L-X type sheaths have been put in service. No sheath failures have been reported.

A new eighteen-pound refrigerator will operate for fifty hours on a bottle of propane gas, or indefinitely on household current.

The problem of shipping giant transformers by rail has been minimized by making the transformer the central part of the car. Both height and weight are thereby reduced.



Of current interest:

Recently, Simplex had the pleasure of publishing a new book called TRANSOCEONICS, depicting the historical development of underseas telephone cables. If you have read TRANSOCEONICS, you will recall the magnitude of some of the projects undertaken by Simplex.

We hope you will also remember that Simplex manufactures cable for nearly every electrical need, regardless of project size. All the proficiency acquired during our seventy years of leadership in cable manufacturing and research is at your disposal. Call or write to:

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Cambridge, Massachusetts and
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Highest quality cables for: Mining · Power & Lighting · Construction · Transportation · Communications · Signalling

"the American manufacturers of transoceanic telephone cables"

GOLD (*Continued from p. 198*)

brought about the rise in our exports last year. Some of the countries that greatly increased their purchases of American goods acquired sufficient dollars by their own exports (Germany, for instance) or as a result of the inflow of U. S. capital (e.g. Canada and Venezuela), but many others over-imported heavily. The seemingly insatiable demand for imported goods in these and many other countries was, of course, the by-product of inflationary pressures that were greatly intensified in late 1956 and early 1957. Toward the year-end, however, U. S. merchandise exports declined markedly; in September-October, they were running at $2-billion less than during the first quarter of 1957.

The second factor in the large losses of gold and dollar reserves by foreign countries was the inflow of speculative funds into the U. S. It obviously reflected the reduced confidence in certain foreign currencies, itself an accompaniment of inflationary pressures and the attendant expectations of exchange depreciation. During the last quarter of the year, this inflow subsided for reasons that are noted below.

The losses of reserves to the U. S. were, therefore, the result *not* of faulty U. S. policies that would have resulted in a decline in merchandise imports, capital exports, and government transfers, but rather of an insufficient resistance to inflationary pressures in many foreign countries. A further conclusive indication that last year's difficulties could not be regarded as a symptom of a renewed "dollar shortage" is that the foreign countries that incurred the largest payments deficits experienced them in relation to all other countries and areas, and not the U. S. alone. France and certain other Continental European countries had sizable payments deficits with Germany; and several Latin American countries had deficits with Europe. Furthermore, speculative capital flows went from the "weak" currencies not only into the U. S. dollar, as noted above, but also into the Canadian dollar and the German mark. Indeed, the large inflow of speculative funds into Germany during the spring and summer of 1957, prompted by rumors about a possible appreciation of the German mark, was one of the most notable financial developments last year; it subsequently subsided and was partly reversed in the remainder of the year.

Another distinguishing feature of last year's payments difficulties was the fact that the United Kingdom, the country that suffered a large gold and dollar loss during the third quarter, had throughout the year a current-account surplus, global as well as with the U. S. The drain on its reserves was not due, therefore, to any excessive spending on imports; indeed, the rise in imports was much less than the expansion of exports since the pressure of domestic demand had been reduced as a result of the restrictive monetary and fiscal policies of 1955 and 1956.

The overseas sterling countries ran sizable great deficits with non-sterling countries, but the major factor behind the severe reserve losses sustained by U.K. during the third quarter of 1957 was the speculative outflow of funds from sterling, set off by market fears of wage and price inflation in Britain and by the uncertainties regarding the European exchange rate structure.

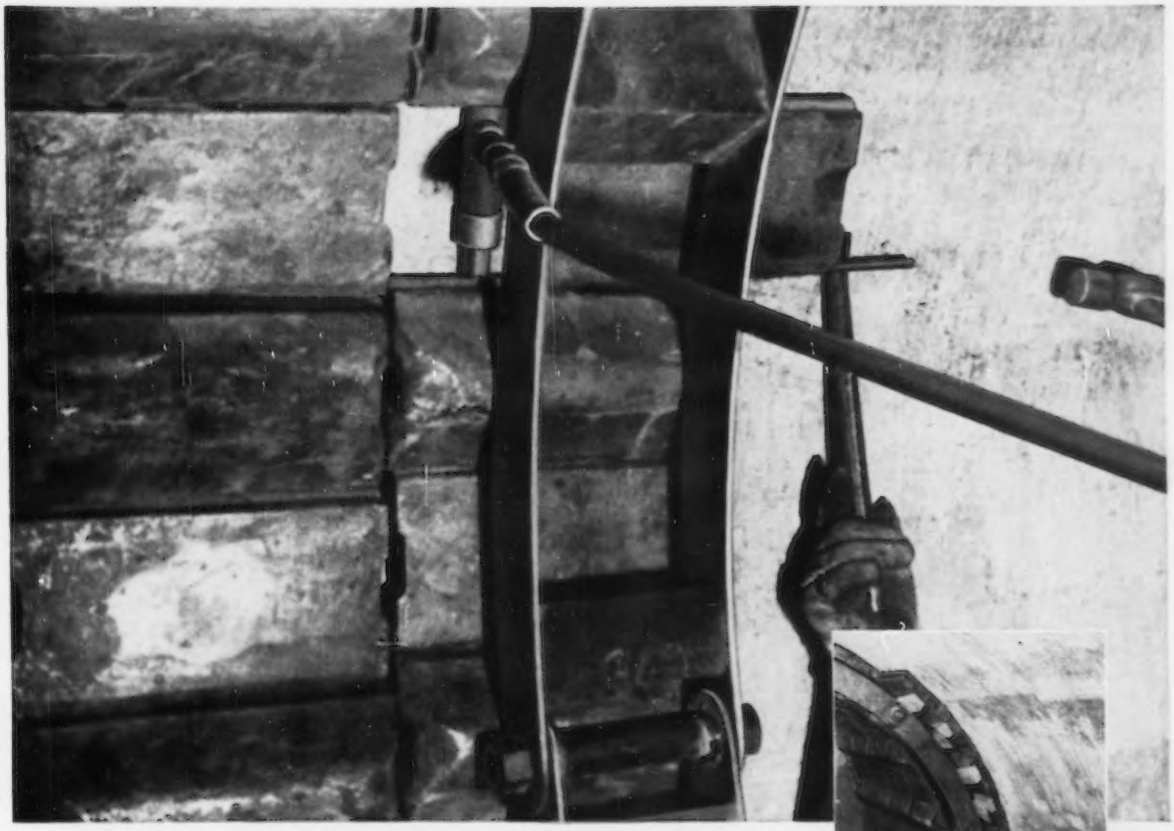
Following the rise in the Bank of England discount rate to 7% last September, and the other measures that showed Britain's determination to defend sterling, sterling regained during the last three months of the year much of its strength in the exchange markets, and Britain recovered some of the reserves lost earlier.

Gold and dollar losses—or gains—of individual foreign countries were often quite different from the transfers of reserves as a result of their transactions with the U. S. Some of the most important changes in gold and dollar holdings during the twelve months ended September 1957 were the rise in Germany's holdings by $965-million and the decline in those of France by nearly $650-million. Gold and United States dollar holdings of Canada rose by $333-million; Canada's foreign trade deficit, which ran at a record rate during the first half of the year, was more than offset by capital inflows attracted by the opportunities to develop natural resources and set up new industries. Changes during recent years in gold and dollar holdings of these three countries—and of the United Kingdom and Japan—are illustrated in chart IV.

The aggregate gold and official and private dollar holdings of sterling-area countries declined some $300-million during the year ended September 1957 to $3,859-million; the central gold and official dollar assets held by the United Kingdom as the area's banker declined by $478-million. This decline would have been much larger had it not been for the $561-million drawing on the International Monetary Fund in December 1956, the $200-million drawing by India on the Fund in the first half of 1957, and the $104-million interest waiver last April on the Anglo-American loans. During the last three months of the year, Britain's reserves rose by $423-million, in part because of the $250-million drawing in October on the Export-Import Bank credit line against collateral of securities.

Aggregate gold and dollar holdings of Latin American countries rose by $589-million; the entire increase, however, was more than accounted for by Venezuela ($794-million, on top of a $146-million increase a year previous, in large part because of oil company payments on account of new concessions). The holdings declined, in particular, in Brazil ($125-million), and Argentina ($86-million, despite a $75-million drawing on the International Monetary Fund). Gold and dollar holdings of nonsterling Asian countries fell by $407-million. Japan's loss amounted to $488-million despite a $125-million drawing on the Fund, and the Philippines' to $63-million.

Altogether, therefore, the reemergence of international payments difficulties after four years of build-up of gold and dollars holdings by foreign countries is a disappointing development. It should not be allowed, however, to obscure two other developments that are reasonably encouraging: First, there has been no general relapse into direct and discriminatory controls over trade and payments, and second, many countries that had implemented adequate monetary controls have succeeded in their endeavor to curb, or at least moderate, inflationary pressures and thus restore a workable balance in their trade and payments. In the closing months of 1957, business activity slackened somewhat in the industrial nations, and as the output of primary commodities tended to exceed world demand, commodity prices weakened. Some cresting out of the earlier rate of economic expansion was, of course, inevitable because of capacity limitations and the readjustment in production patterns that accompanied the curbing of excessive demand and the resulting shifts in productive resources. A reshuffling of resources from sectors that are contracting in relative importance into those that are expanding to meet the requirements of economic growth can, obviously, take place only if inflationary pressures have been brought under control; but it will tend to make the economy more flexible, more resilient, and more adaptable to changing circumstances•



How B&W Standardized Universal Liner Plates Speed Mill Installations

Uniform Castings Fit All Mill Sizes

B&W Universal Liner Plates save manhours and reduce mill downtime because they are quick and easy to install. Since the same casting fits all mill sizes, B&W standardization also means lower costs, higher performance, longer life and less breakage in your operations.

Here is the simplified installation procedure:

1. Lay liners in bottom half of the mill with the desired lifter centers.
2. Then, place in position a simple installation form and complete the ring of liners without turning the mill. The last casting in each ring is wedged tightly into place by means of a hydraulic ram and locked with a pin. The joints are designed to permit the use of a spacer pin where needed. The number of pins in a ring depend upon shell variations and lifter centers used.

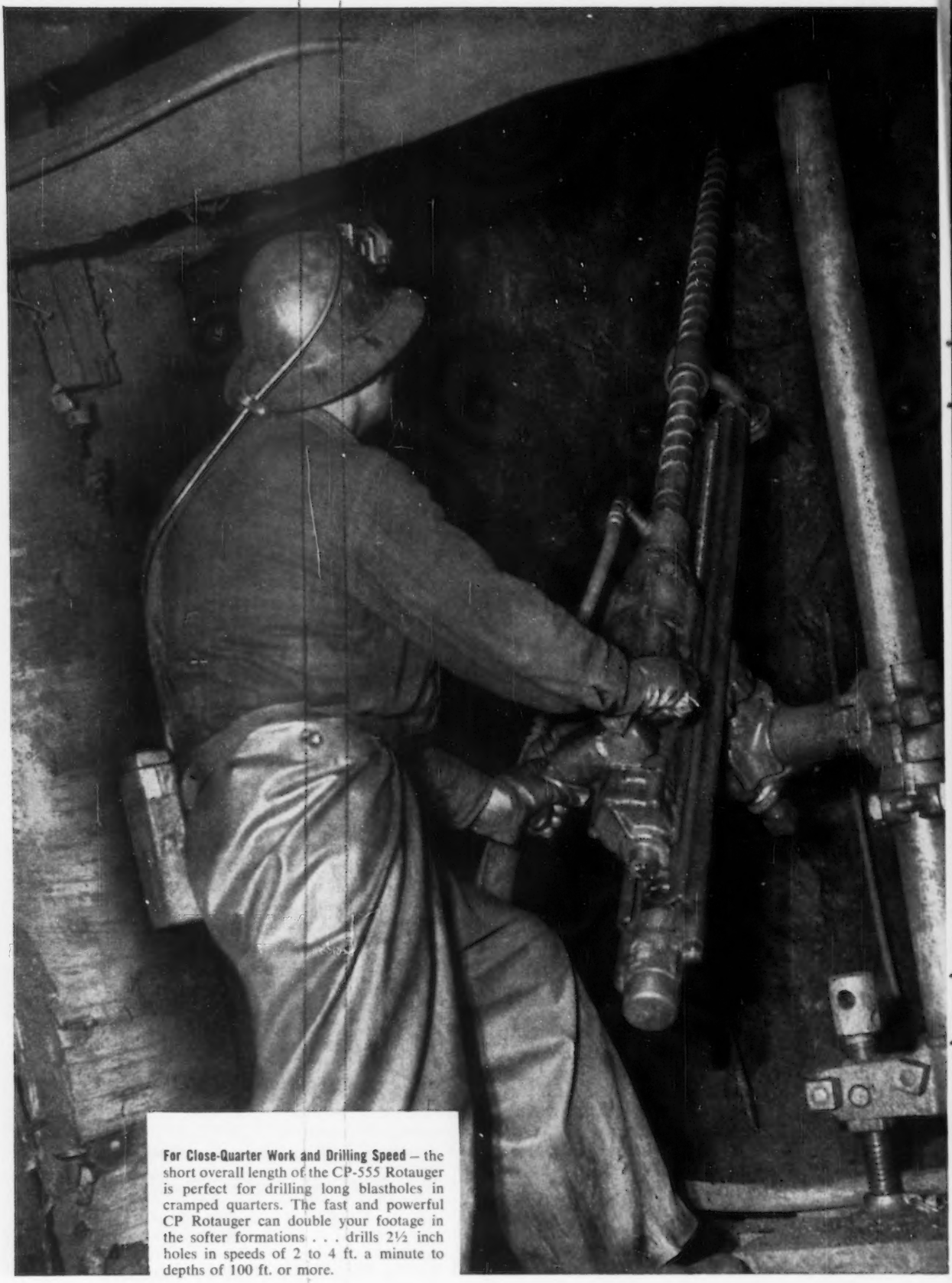
With B&W Universal Liner Plates, direct labor cost and installation downtime are reduced. Small, lightweight castings are easily handled, minimizing worker fatigue and eliminating the necessity for cranes. Also, B&W Universal Liner Plates give longer life of greater usefulness. Uniform wear results from better quality control on a mass production casting with permanent molds. You save money on liner inventory, breakage claims and delays for replacements. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. Costs are also reduced for storage space since small castings stack easily.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. For additional information on B&W Universal Liner Plates, write The Babcock&Wilcox Company, Process Equipment Dept., Barberton, Ohio.

S-472

BABCOCK & WILCOX

BOILER DIVISION



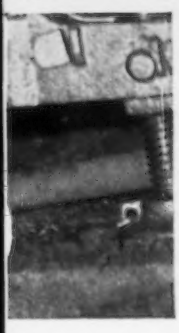
For Close-Quarter Work and Drilling Speed – the short overall length of the CP-555 Rotauger is perfect for drilling long blastholes in cramped quarters. The fast and powerful CP Rotauger can double your footage in the softer formations . . . drills 2½ inch holes in speeds of 2 to 4 ft. a minute to depths of 100 ft. or more.

There's a CP drill for every mining need!

For Complete Versatility – CP Integral and Attachable Airlegs teamed up with Chicago Pneumatic Sinkers get the most out of tungsten-carbide bits. The Attachable type is ideal for mounting standard sinkers for intermittent or production drilling; the Integral type is designed primarily for production drilling . . . both models in standard feeds of 36″ and 48″.

For Blast Hole and Exploratory Drilling – the powerful, lightweight, easy-to-handle CP-55 Diamond Core Drill is faster than any other diamond drill in its class. Has a highly efficient CP Rotary Air Motor . . . requires a minimum of air per foot drilled. Conservatively rated at 500 feet with E Rods and EX Fittings. Skid mounted types are available for test borings . . . rated in capacities to 2250 ft.

For Stoping and Raising – the CP-34 Stoper has just-the-right combination of piston speed, foot-pound blow, rotating speed and feed-leg pressure to achieve that extra long service and performance from tungsten-carbide bits.



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WASHINGTON IMPACT

Highlights

SURVEYS AND OUTLOOKS—Government reviews of the year past and predictions for the year ahead are generally bearish for metals and minerals—the pattern of oversupply and sagging demand and prices broken by only a few bright spots for the newer, lighter, atomic materials (see story, this page). Here are three indicators:

BDSA PREDICTS—For a few selected materials, Commerce Department's Business and Defense Services Administration comes up with these comments:

Aluminum—If production stays at present levels, demand and price will not change significantly this year. But a higher consumption of aluminum by the automobile makers in new models will be an important market.

Copper—Demand may turn up by the third quarter, though probably not before. But a "more favorable supply-demand balance" should stabilize prices and buying practices. Up to 10,000 tons a month may become eligible for Government purchase under "put clause" contracts.

Columbium-Tantalum—The stepped-up missile program should boost both production and demand.

Magnesium—Both production and consumption will drop below last year's levels.

Manganese—Government purchases of type-B metal may increase.

Nickel—Production goals of 440-million lb per year will be met by 1961.

Titanium—A second-quarter upturn in Government orders may help drain off some inventory excesses, but no big upsurge is in sight. (Aircraft cut-backs may also hurt.)

Tungsten—Government stockpiles are already overloaded.

ODM REPORTS—Best indication of how military orders are falling below even current estimates of requirements (see story this page) is an Office of Defense Mobilization announcement of second-quarter allotments of mill-level purchases for defense contractors:

Aluminum—93.3-million lb, down 10% from the first-quarter allotment.

Copper and copper-base alloys—35.2-million lb, down about 17%.

Nickel alloys—6-million lb, down approximately 25%.

Steel—417,000 tons, down nearly 10%.

BU MINES EVALUATES—Equally bearish was the Interior Department's Bureau of Mines annual report on the dollar value of metals and minerals produced in the U.S. in 1957. The total value of metals output dropped from $2- to $4-billion in 1956 to $2.1-billion.

Non-metallic minerals increased slightly in value from $3.4-billion to $3.5-billion, but this was almost entirely due to higher prices, not increased production.

Bauxite, chromite, copper, gold, lead, phosphate rock, silver and tungsten all declined in both amount produced and total value.

Barite, cobalt, ilmenite, mercury, rare earths, and uranium were the only items to register both quantity and value increases, again emphasizing the trend to atomic-age materials.

A few of the most serious declines were these:

Gold output—valued at $62-million—was the lowest since 1945.

Lead and zinc dropped 5% in both production and consumption, 11% and 20% in value, respectively.

Copper production declined 5%, consumption 15%, price more than 30%.

The mines bureau report summed up 1957 in these words: "The year was turbulent for many mineral-producing industries."

Checklist—1958

THE "URGENCY" of Washington's annual soulsearch into the State of the Union this year doesn't promise anything very new or very startling in the way of Government policy for the metals and minerals industries. In fact, the nub of the unusually heavy flood of economic predictions and advice from Federal agencies and citizens' committees is that most producers and processors will have to live with the same basic problems of supply and demand in a generally soft world commodity market this year as last (see highlights, this page).

But Government policies will make more news than ever, and the controversies they stir will be worth watching as indicators of trends to come. Here are the areas to watch, and some points to keep in mind:

Trade Policy—This is by far the most important item on Washington's agenda to the metal-mineral industries. The Administration is up to its neck in what House Speaker Sam Rayburn (D-Tex.) calls "a whale of a fight" to hold to a moderately liberal trade and tariff policy centered around extension of the Reciprocal Trade Agreements law.

The key to what kind of trade policy will emerge by late summer is: how far the White House will go in adopting administrative restrictions to trade liberalism in order to mollify the strongest protectionist sentiment in Congress in a quarter-century. If it steps up import tariffs and quotas much beyond existing rates, the effect will be the same as if Congress legislates new restrictions. If, on the other hand, the White House fails either to muster enough pro-liberal support or satisfy some protectionist demands, a defeat of the trade agreements law could slowly crumble the whole present trade program.

Although it must be regarded as talk so far, some Capitol Hill committee staffers are saying that the trade law may be beaten no matter what the White House does, and have gone so far as to draft new legislation to take its place. This would revert tariff schedules to the 1934 levels, and give the Tariff Commission a sweeping new role in administering tariffs and quotas.

A more likely outcome of the trade debate is that new restrictions may be written into existing law, perhaps including some specific commodity quotas, and narrowly passed for a shorter period of time than the five years asked by the White House.

Mining-state Congressmen say that at the very least new legislation affecting metals and minerals will come only in the field of trade. Sen. James Murray (D-Mont.), chairman of the Senate Interior Committee, was joined by 27 colleagues on both sides of the political aisle in both houses in introducing new copper tariff legislation late last month. The new bill would raise the copper import peril point to a 30c per lb price

from the current 24c floor, and raise the duty that would then apply to 4c per lb. The existing 1.8c duty is under Congressional suspension, but in the absence of new legislation, that suspension ends this year, and a 1.7c duty goes into effect automatically.

New tariff bills for other metals are sure to follow, including tungsten, fluorspar and chromite.

Whatever action — Administrative or Congressional—that is taken on metal tariffs, Government economists do not look for significant boosts in domestic prices. If U.S. prices firm up beyond an indeterminate point, this argument runs, foreign materials will again flow in and push the price level back down.

Stockpiling—The new budget further confirms what everyone knows, that Government stockpile purchases are fast coming to an end. Total outlay for fiscal 1959 is budgeted at $421.9-million, down from $564.8-million in fiscal 1958. The figure includes $70-million in so-called new money authorization, but this will go only to meet part of the Government's prior commitments, including "put clause" contracts, and doesn't even make up for the $90-million Congress struck from last year's purchase funds.

On top of this, the Office of Defense Mobilization's citizens' advisory committee on stockpiling is recommending an end to swelling reserves which it has concluded are already more than sufficient to meet any military emergency. For a brief time, the Committee is said to have even considered proposals to sell off some Government stocks, although this was later rejected as impossible because of its obvious effect on commodity.

Other Federal support—Congress is wondering what happened to the Senate Interior Committee which is planning a study of other Government support programs as a spur to Interior Secretary Fred Seaton's long-range mining aid package. So far, the Seaton Doctrine has resulted primarily in new budget requests for research and development money—up $1.3-million for fiscal 1959 to a $18.5-million total outlay. This underscores the Seaton Doctrine emphasis on plans to subsidize more exploration and better mining and processing techniques.

Civilian markets—the Seaton Doctrine approach in turn reflects Government economists' beliefs that the future for most metals and minerals lies in perfecting new forms and new uses to create new civilian demand.

In addition to creating bigger markets, some Washington officials are also pointing to stepped-up investment overseas as one way for mining interests to ease their economic pinch. A few Government experts are even talking voluntary production controls and the possibility of taking a new look at some form of international commodity agreements — although this traditional temptation is hampered by the equally traditional Government opposition to anything that smacks of cartelization.

Labor This Month

MINE-MILL WOOED—BUT NOT WON: Overtures are still being made to the Independent Mine-Mill and Smelter Workers union to join affiliates of the merged AFL-CIO. Two factions within the labor federation have attempted to tie up MMSW, but, partly because they are rival units, neither has made headway. Here's what is happening:

- The AFL-CIO Steelworkers Union, chief bargaining rival of Mine-Mill in the nonferrous industry has had discussions on taking the MMSW union into the Steelworkers. USW officers report no success so far in the effort, which would be less of a merger than an absorption. Also, the steel union leaders admit failure in their organizing efforts in nonferrous mining.
- AFL-CIO's metal trades department also has struck out so far with an attempt to take jurisdiction of metal miners. Department president James A. Brownlow pushed through a resolution in his metal trades division appealing to the AFL-CIO convention to grant it a charter over this industry. However, because of rival jurisdictional claims by the Steelworkers Union the appeal got nowhere. Thus, from within the AFL-CIO it looks like a standoff.

STEELWORKERS' RECESSION REMEDY: USW president David J. McDonald offered a four-point solution to the nonferrous industry's economic troubles recently—one that won't find much support from management. Lining up the Steel Union position at a meeting on nonferrous conference, the union official argued against tariff protections as "poision." Instead, he reiterated the union cure of economic ills:

(1) Technical and financial assistance to hard-pressed companies,

(2) Government contracts and encouragement of construction of new industries in depressed mining areas,

(3) Subsidy and assistance for workers thrown out of jobs and,

(4) Retraining of workers at Government expense with all benefits accrued from previous employment to be carried over to new jobs.

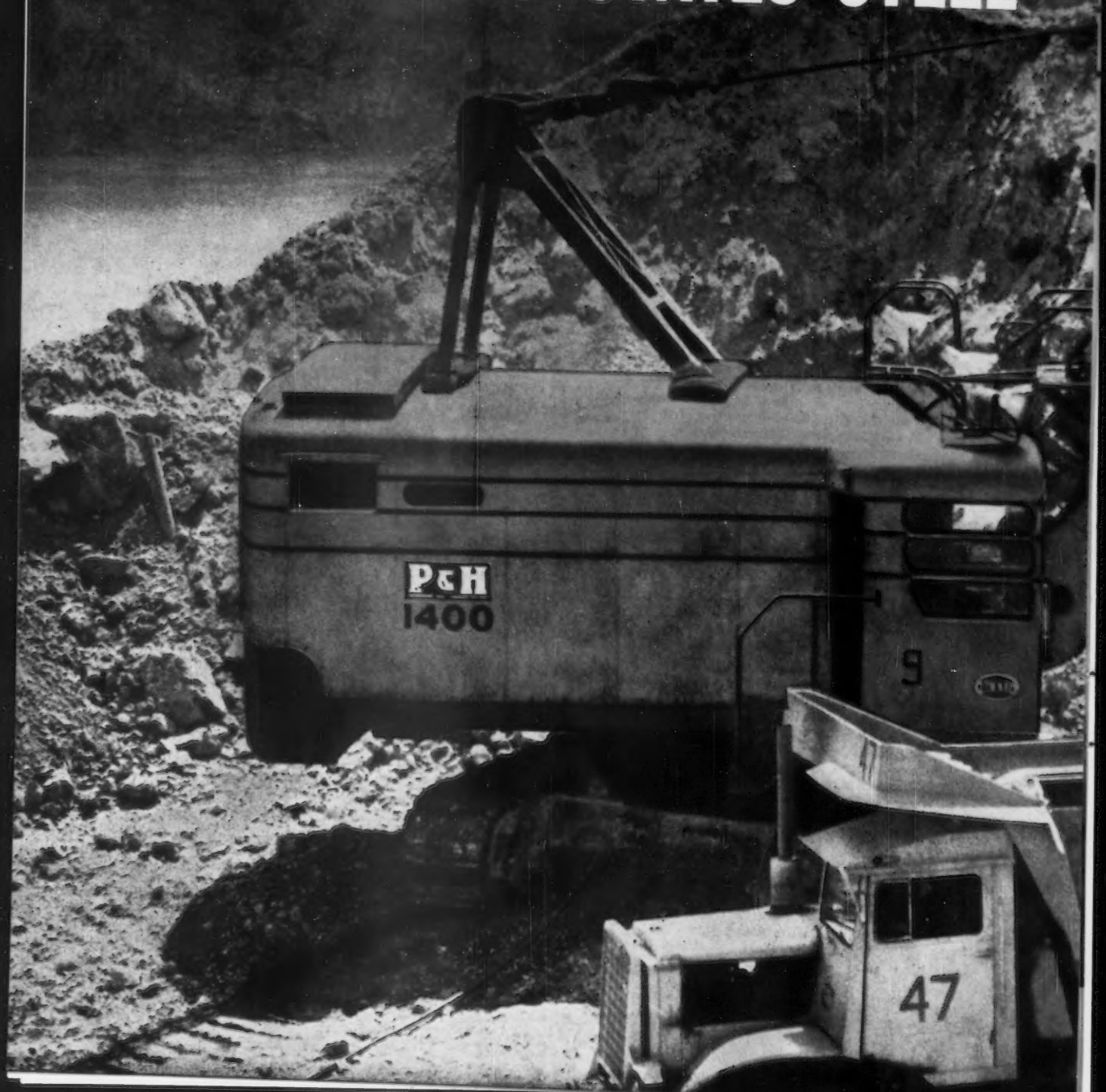
UNEMPLOYMENT MOVES AHEAD: The steady rise in the jobless count is showing up in all industries. Nonferrous is no exception. In seven months, more than 5,000 workers in copper mines and smelters have been laid off, by unofficial count. And more pink slips are expected to show up during this month. Government's official tabulation on metal mining employment shows a steady drop through 1957. At the end of the year, there were 103,000 employees in metal mining; at the start there had been 111,000. This was a decline of 7.4% over the 12 month period.

The national picture looks just as bad. Latest unemployment figures show 3.4-million unemployed, a three-year high at 5.2% of the work force. And, the rise is showing up everywhere. All states report an advance in unemployment compensation payment totals. Manufacturing payrolls are still declining—by 250,000 in the month of December. The work week, at 39.3 hours was the lowest for December since World War II. And overtime fell off to an average two hours a week. Still, the worst is yet to come. The jobless total will advance at least through March and may reach 5-million or more.

SUPPLEMENTARY PAYMENTS GET ATTENTION: Labor unions are concentrating more and more on supplementary unemployment benefits because of the layoff picture. And, they're turning to the involuntary part-time worker as their next beneficiary under sub plans. United Steelworkers already have contracts providing sub payments to workers on an enforced short work-week. Wherever an employee's limited working hours don't provide 65% of his normal take-home pay—the financial ceiling for the laidoff worker under sub programs—his company will make up the difference. However, USW has renegotiated a deal with the industry changing payment methods. In the past, payments have been made only after the part-time employee has gone through a full week's layoff. This stipulation applies no longer, since such employees usually aren't put on a full layoff.

ALONG THE

P&H ELECTRICS ARE WORKING FOR UNITED STATES STEEL



UTAH RANGE

In their iron mining operations in southern Utah, United States Steel's Columbia Iron Mining Company is using *three* P&H 1400 Electrics. You will find P&H Electrics delivering dependable production in mining operations throughout the world.

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MAGNETORQUE®... transmits power from the hoist motor to the dipper electro-magnetically for fast action and at the same time, eliminates shock and impact to the hoist gear train and motor. Response is immediate to varying load conditions.

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It will pay you to choose from the complete P&H line. P&H Electric Shovels from 3½ through 10 cu. yds., P&H power shovels from ½ through 4 yds., truck cranes from 10 through 60-tons. In addition, P&H offers single source service responsibility.

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WHAT'S NEW IN U. S. PATENTS

OLIVER S. NORTH

Mining

Short delay quarry blasting method and equipment whereby possibility of shots firing out of order is eliminated, and wherewith any desired number of shots may be fired in a round. Electric current is passed through each succeeding detonator fusehead by way of an electric delay switch interposed between it and the preceding detonator. J. C. R. Cance, assigned to Imperial Chemical Industries Ltd. No. 2,814,991.

Detachable drill bit insert. Longitudinal surfaces of the insert are partially conical in shape and diverge from inner to outer edges. Insert is securely held by the tool without being soldered or welded. J. Dionisotti. No. 2,815,933.

Method treating water supply used in Frasch-Process mining of sulphur. A small percentage of mud, clay or gypsum is added to the water before it is heated to the required high temperatures. Scale-forming salts in the water tend to deposit on the additive particles, rather than on equipment. B. A. Axelrad, assigned to Freeport Sulphur Co. No. 2,817,504.

Construction for shelter and/or escape tunnel for mines. Flameproof, explosion-proof doors are provided. The tunnel is connected to a mine shaft, and means provided for supplying air and water to trapped miners. Steps into chamber are integrally formed as part of the reinforced concrete liner and passageway. W. M. Inman. No. 2,817,505.

Metal and Mineral Processing

Improved means for adjusting viscosity of heavy-material suspensions in dressing ores by sink-float methods. Fine-grained, viscosity-increasing components are centrifugally separated and the specific gravity of that partial stream continuously determined and controlled so as to regulate the viscosity of the heavy liquid fraction. R. Teuteberg, assigned to SKB Schuchtermann & Kremer-Baum Aktiengesellschaft fuer Aufbereitung. No. 2,817,439.

Recovery of titanium tetrachloride from chlorination gases obtained during chlorine reduction of titanium ores or slags. Mixed gases are condensed by cooling. Resulting condensate is subjected to mechanical separation of liquid and solid phases, preferably by centrifugation. A liquid $TiCl_4$ fraction is separated from a slurry containing virtually all of the solid phases, especially $FeCl_3$ and $AlCl_3$. R. J. Mas and P. R. Matthieussent, assinged to Fabrique de Produits Chimiques de Thann et de Mulhouse. No. 2,815,091.

Improvement in froth flotation of Florida phosphate rock. Silica, rather than phosphate, is floated with a cationic collector in the first stage, and the rougher phosphate concentrate sized to relatively coarse and fine fractions. Additional silica is removed by subjecting each fraction to flotation cleaning, using a different cationic collector than was used in the rougher stage. First collector can be a sulphuric acid-amine-hydrocarbon reaction product, and the cleaner collector an unmodified amine. C. A. Hollingsworth, assigned to Smith-Douglass Co., Inc. No. 2,815,859.

Recovery of uranium from acid solutions produced during H_2SO_4 leaching of uranium ores. The pH is brought to about 1.4, and aluminum metal is used as the reducing agent instead of metallic iron. As reaction proceeds, pH rises and selective precipitation of uranium occurs. Use of aluminum prevents precipitation of phosphate and arsenate ions in this pH range. A. Thunaes, E. A. Brown, H. W. Smith and R. Simard, assigned to U. S. Atomic Energy Commission. No. 2,815,261.

Process for separating and recovering thorium values from monazite sand. The pH of a sulphuric acid-monazite solution is increased step-wise from 0.8 to 5.5 to induce selective precipitation of thorium, rare earth and uranium values. G. L. Bridger, M. E. Whatley and K. G. Shaw, assigned to U. S. Atomic Energy Commission. No. 2,815,262.

COPIES OF U. S. PATENTS can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

Treatment of oxide ores of uranium, for example, carnotite, containing other metals such as molybdenum, vanadium or tungsten. Ground ore is leached with an alkali metal cyanide solution to dissolve metal values, and the metal-enriched solution drawn off. R. B. Eldredge. No. 2,815,263.

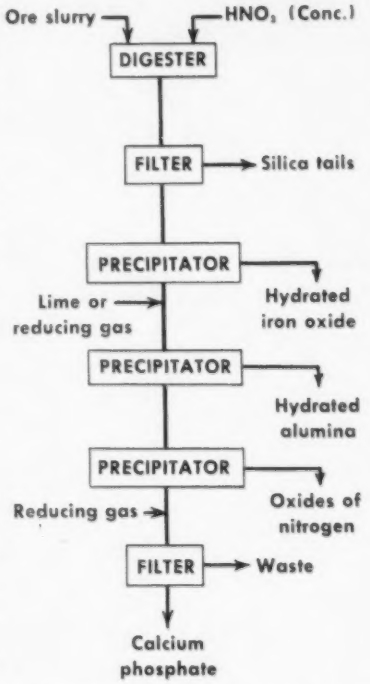
Hydrometallurgical processing of monazite sand for relatively low-cost recovery of uranium, thorium and rare earths. G. D. Calkins and E. G. Bohlmann, assigned to U. S. Atomic Energy Commission. No. 2,815,264.

Single-step process for recovery of plutonium from solid compositions containing it, such as certain fission products, for example, acid solutions of neutron-bombarded uranium. L. B. Werner and O. F. Hill, assigned to U. S. Atomic Energy Commission. No. 2,815,265.

Recovery of metallic tin or tin dioxide from oxide ores of tin. Ore is subjected to a reducing gas at elevated temperature to form gaseous stannic oxide. Material is purified of reducing gas and oxidized at a temperature not lower than temperature of formation. J. C. Platteeuw, G. Meyer and G. A. M. Diepen, assigned to N. V. Billiton Maatschappij. No. 2,815,267.

Production of water-soluble lithium salts from spodumene. Ore is heated to 1050 deg C, cooled, and treated with dry sodium acetate or potassium acetate at a temperature betwen 280 deg C and 324 deg C. Reaction product is cooled and extracted with a solvent, and the lithium acetate obtained thereby treated with an alkali carbonate to precipitate lithium carbonate and regenerate the saline cation exchange agent for reuse. A. V. Kroll, assigned to Compagnie Geologique et Miniere des Ingenieurs et Industriels Belges "Geomines" Societa par Actions a Responsabilite Limitee. No. 2,816,007.

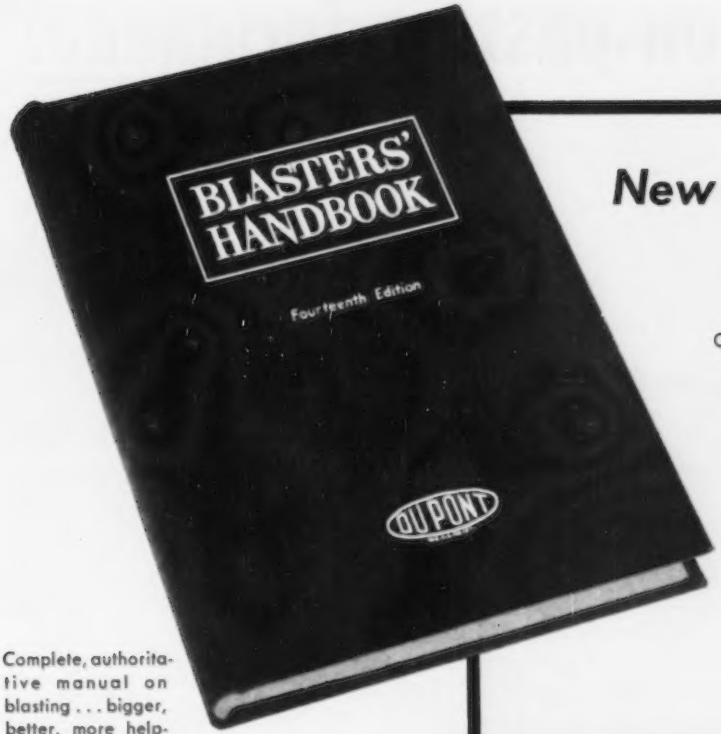
ALUMINA FROM CLAY



Recovery of high-grade alumina from ores or phosphatic clays containing appreciable amounts of iron. Impure acid solution is subjected under pressure to selected conditions including elevated temperature and controlled acidity to cause precipitation of the iron. Flowsheet outlines major steps in this process. T. H. Milliken, Jr., assigned to Houdry Process Corp. No. 2,817,578.

Improved process for pelletizing magnetite concentrates. Carbon content of the green pellets is held comparatively low, temperature of treatment gas is substantially higher than that used on conventional practice, and pellets are maintained at peak temperatures for a relatively long period. Product has less void space, is more uniform in quality, and less likely to break up in handling. F. D. De Vaney, assigned to Erie Mining Co. No. 2,816,016.

Mr. North is patent consultant, Washington, D.C.



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Vice-president L. D. Riffe of the Dulin Bauxite Company, Inc., Sweet Home, Arkansas. Using three DW21s and a D9 on the job, in addition to this Cat No. 12 Motor Grader, Mr. Riffe says of his Cat-built equipment: "The only non-operative periods are due to bad weather."

That's the way L. D. Riffe, vice-president of Dulin Bauxite Company, Inc., feels about CAT machines including this rugged, versatile No. 12 Motor Grader. The machine is maintaining haul roads on bauxite mining operations near Little Rock, Ark.

The Dulin Company, like other big outfits who must count on *continuous* operation of earthmoving machines for high production, knows from experience that it can rely on Caterpillar equipment to get the job done on time. On this contract the Dulin spread must move 2,300,000 cu. yd. from three pits, stripping to an average depth of 83 ft.

The Cat No. 12 Motor Grader is the acknowledged "standard of the industry"—with a solid reputation for minimum down time. It's preferred by operators for its operating ease and comfort, a popularity earned on the job. And add the following features:

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Caterpillar Tractor Co., Peoria, Ill., U. S. A.

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WANTED—
THE HARD WORK

THIS MONTH IN MINING *(Continued)*

AIME Plans Annual Meeting in New York

These will be the Society of Mining Engineers' main program items at the AIME annual meeting, New York, Feb. 16 to 20.

Key:

EMD—Extractive Metallurgy Division of the Metallurgical Society of AIME.

IndMD—Industrial Minerals Division.

ISD—Iron & Steel Division of the Metallurgical Society of AIME.

MBD—Minerals Beneficiation Division.

MGGD—Mining, Geology, and Geophysical Division.

Min—Mining Subdivision.

Geol—Geology Subdivision.

Geoph—Geophysical Subdivision.

SEG—Society of Economic Geologists. (holding joint meetings with SME divisions)

Mineral Economics sessions are sponsored by the Council of Economics.

EMD Sessions:

1. Solution and Precipitation, Thursday, 9:00 am
2. Symposium: Thickening, Filtration and Flocculation, Thursday, 2:00 pm

IndMD Sessions:

1. Mine Hydrology, Monday, 9:00 am
2. General Industrial Minerals, Monday, 2:00 pm
3. Geology of Titanium, 9:00 am, Tuesday
4. Luncheon, 12:30 pm, Tuesday
5. Uranium, Thorium, and Beryllium, Wednesday, 9:00 am
6. General Industrial Minerals, Wednesday, 2:00 pm

ISD Session:

Pyrolysis and Agglomeration, Thursday, 9:00 am

MBD Sessions:

1. Crushing and Grinding, Monday, 9:30 am
2. Concentration, Monday, 2:30 pm
3. General Industrial Minerals, Monday, 2:00 pm
4. Theory of Concentration Processes, Tuesday, 10:00 am
5. Mill Design, Wednesday, 9:00 am
6. Magnetic Separation, Wednesday, 2:00 pm
7. Pyrolysis and Agglomeration, Thursday, 9:00 am
8. Solution and Precipitation, Thursday, 9:00 am
9. Developments in Operating Control, Thursday, 2:00 pm
10. Symposium: Thickening, Filtration and Flocculation, Thursday, 2:00 pm

MGGD Sessions:

1. Some Economic Considerations in Exploration Geology, Wednesday, 9:00 am

Man in the News——

Henry Kearns—Commerce Voice on Tariffs

WASHINGTON'S NEWEST VOICE on foreign trade and tariffs belongs to Henry Kearns, Assistant Secretary of Commerce for International Affairs. As chairman of two recently formed trade advisory committees—one a cabinet-level board which reports directly to the President, the other a private business-citizens' group—Kearns is a leading spokesman for the Administration's present trade policy.

More than that, he personifies it. His official function is itself an outgrowth of White House efforts to reconcile a basically liberal foreign trade philosophy with rising industry pressure for more protection from increasing import competition. Kearns' own background and personality underscore both what the Administration is trying to do, and how it is trying to go about it.

Kearns came to the job last fall, as the White House began stepping up Commerce Department's role in trade policy matters to quell protectionist charges that domestic business interests play second fiddle to foreign policy at the State Department. The assignment of Commerce Department's International Assistant Secretary to head the Cabinet's trade advisory committee, and the setting up of an industry advisory forum were the two main steps.

The Cabinet committee replaces a previous advisory group made up of lesser officials from the various agencies involved in trade matters—Interior, Treasury, and Agriculture, in addition to State and Commerce. The new group will review and make recommendations to the President on such matters as Tariff Commission findings, tariff negotiations under the General Agreement on Trade and Tariffs (GATT), customs, procedures and Office of Defense Mobilization hearings on the threat of imports to national security.

Its scope is broad, and fairly general. With higher-level representation from the several agencies concerned, it has more prestige. Kearns describes the new set-up as "giving Commerce Department a greater influence in trade policy matters, based on the needs of domestic economy rather than international politics."

But the new board's function is not to reverse the Administration's commitment to liberal trade as such. The State Department's representative, Deputy Undersecretary For Economic Affairs, C. Douglas Dillon, is a firmer advocate of liberal trade than White House trade advisors headed by Clarence Randall.

The new industry forum is a less formal conference of some 60 business and professional representatives from private life. Kearns will preside over this group four times a year, both to explain Administration policy to them and get their recommendations on how that policy should be carried out.

"—advocate of trade liberalism"

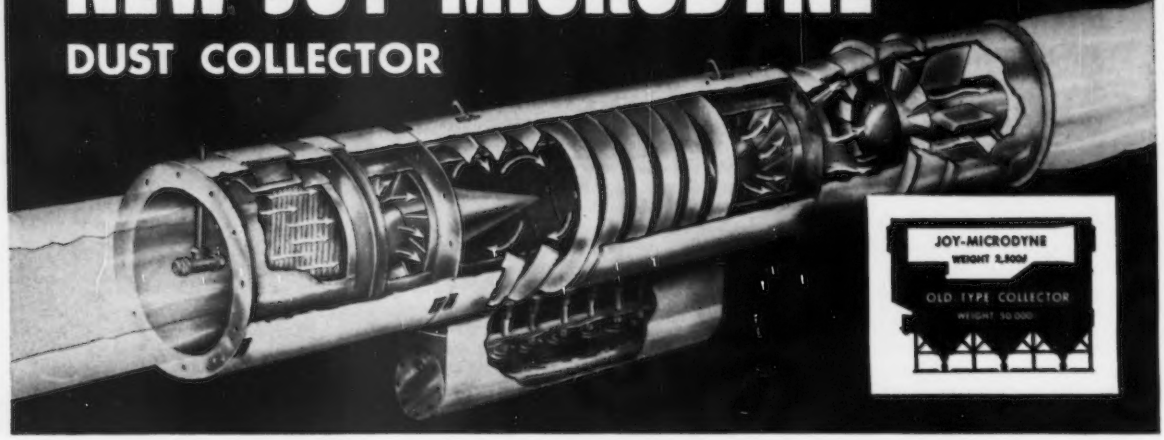
Kearns' job will be difficult and delicate. He must try to contain the pressures of protectionists and freer traders alike, both inside Government and from the outside business community, and persuade them to follow the Administration's position on any given trade question. At the same time, he must help recommend a razor-fine policy line between proponents on either side of it, bending it here and there to satisfy the minimum requirements of both.

To this task of salesmanship and judgment, Kearns, 46, brings such varied experiences as these: he has been owner-manager of an automobile dealership in his adopted home state of California, vice president of the U. S. Chamber of Commerce, and member of a Hoover Commission task force on international intelligence activities. An advocate of the Administration's trade liberalism, he represents at the same time American small business, having been engaged in the businesses of real estate development and management, insurance, savings and loan, and citrus growing, in addition to his automobile dealership. He was president of a small tool and die manufacturing plant, and invented several industrial plastic items.

Active also in politics, he was on the California Republican state central committee and Southern California's 1956 Eisenhower campaign chairman.

Born and educated in Utah, Kearns married a Los Angeles girl in 1938, and now makes his home in La Verne, Calif. The Kearns' have four children, including a pair of twins.

NEW PROVED JOY-MICRODYNE
DUST COLLECTOR



Profile of a Problem Solver

Here is an in-duct "educated pipe" that laughs at space, weight and water limitations as it collects over 99% of dust 5 microns and larger; 92% of 2-micron dust, and substantial amounts of smaller dust.

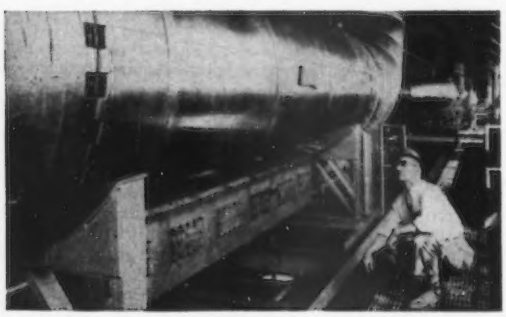
Particles enter through water-saturated air, slam against a water-film-covered impingement element, encase themselves in water droplets as they pass through, then whirl and collect on the sides of the middle section, to finally drain into a sump. Cleaned air is straightened and thrust on its way by an integral Joy Axivane Fan.

SAVES SPACE—Installs as an integral section of ductwork; requires only 1/10 to 1/20 the space of conventional units. 2500 cfm unit is 10 feet long; 1.5 feet in diameter.

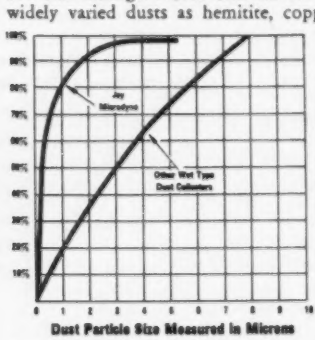
SAVES WEIGHT—Even the largest unit—64,000 cfm, 5 feet in diameter, 32 feet long—weighs only 6,500 pounds . . . or 1/5 the weight of conventional collectors. 2,500 cfm unit weighs only 325 pounds.

SAVES WATER—The largest Joy collector requires only 48 GPM flow—much less than comparable wet collectors. Add a Delpark Filter (Sold by Joy) and water can be recirculated to recover valuable dusts. The filter also reduces water borne solids to give a dependable, clear water supply from a dirty water source.

SUCCESSFUL INSTALLATIONS—Joy collectors from 500 cfm through 64,000 cfm are *now in use* collecting such widely varied dusts as hemitite, copper and uranium ores, coal, quartz, limestone, phosphate, stainless steel and titanium carbide grindings. For answer to your dust collecting problems, write, wire or call: ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** *In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



This 48,000 cfm installation shows compact assembly and space economy of in-duct placement.



Performance graph of actual installation shows efficiency of the Joy-Microdyne Dust Collector. (A micron is 1/25,000 inch)

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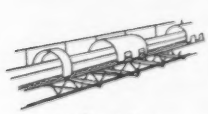
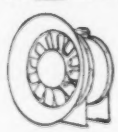

Conveyors

Industrial Compressors

Electrical Connectors


Fans and Blowers

See data on other Joy products in this issue

AIME *(Continued)*

2. Division Luncheon, Wednesday, 12:00 noon
3. Jackling Lecture, Wednesday, 2:00 pm

Min Sessions:
1. Open Pit Mining, Monday, 9:30 am
2. Safety and Health, Monday, 2:30 pm
3. General Mining, Tuesday, 9:00 am
4. General Mining, Thursday, 9:00 am
5. Canadian-Latin American Session, Thursday, 2:00 pm

Geol Sessions:
1. Selected Geologic Topics, Monday, 9:30 am
2. Copper Mineralization and Regional Structure in Arizona, N. M., and Sonora, Monday, 2:30 pm
3. Geology of Titanium, Tuesday, 9:00 am

Geoph Sessions:
1. General Session, Tuesday, 9:00 am
2. New Exploration Techniques, Thursday, 9:00 am
3. New Exploration Techniques, Thursday, 2:00 pm

SEG Sessions:
1. Copper Mineralization and Regional Structure in Arizona, Monday, 2:30 pm
2. Geology of Titanium, Tuesday, 9:00 am

Mineral Economics Sessions:
1. Monday, 2:00 pm
2. Wednesday, 9:00 am

Mine Water Saves Mexican Village

INGENUITY AND KNOW-HOW HAVE turned a misfortune into a blessing at Chihuahua's San Antonio Mine. San Antonio mine is part of the Santa Eulalia Unit, operated by Asarco, S. A., subsidiary of American Smelting & Refining Co.

The following story, taken from the *Asarco News Letter*, shows how mining benefited the Chihuahuan village of Aquiles Serdan in an unusual way.

"Each spring a small group of Mexican farmers calls at the Santa Eulalia Unit office to ask a question that can change the course of their lives for the summer ahead—'How is the water supply?'

"On being told that the supply shows no signs of diminishing, they depart happily to plant the corn, beans, squash and chile necessary to their existence.

"From the time of its discovery many years ago, the San Antonio Mine at the Unit had been a 'dry mine.' But in November 1945 a unique occurrence caused it to change drastically. A routine blast was set off, which broke into a water course about 1300 ft underground. Water poured into the mine at the rate of 100,000 gpm.

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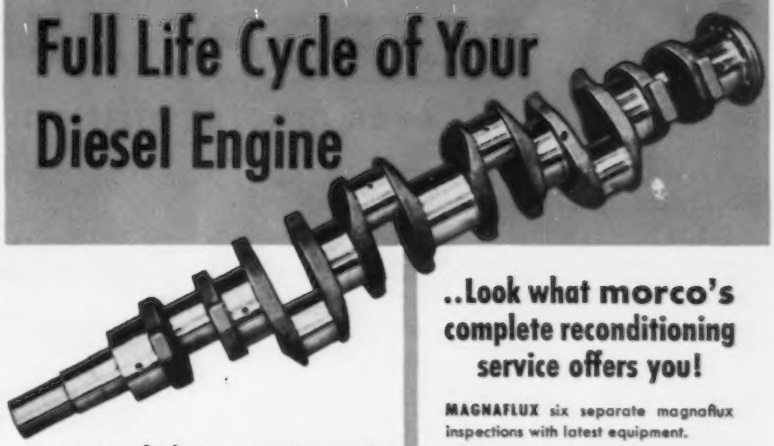

morco dealers—coast to coast—are stocked with reconditioned, like-new crankshafts for different diesel engine models. Users of Detroit Diesel and Cummins engines can exchange worn shafts for MORCO factory-reconditioned shafts through authorized dealers.

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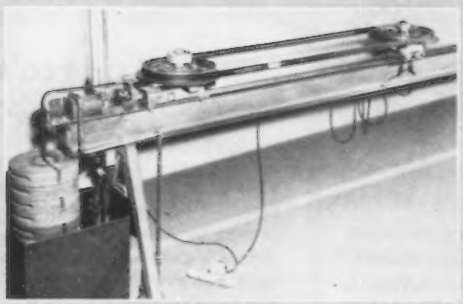
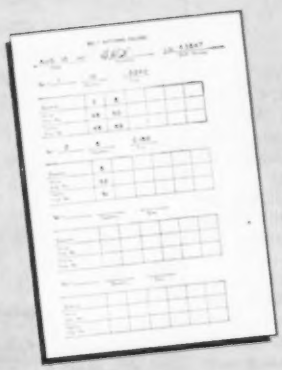


Step 1 — Immediately after manufacture, every *Texrope* belt is accurately measured on modern equipment and its length is coded on the belt.

Step 2 — Belts are then grouped in *matched* sets at the factory. These belts must adhere to minute length limitations.

Step 3 — Distinctively colored tags are used to mark each matched set, thus assuring you true performance on multiple V-belt drives.



Step 4 — A factory record is kept of the belts furnished in each set. This permanent registration is the user's "insurance policy" against mismatching. AND, if prolonged factory stocking should occur, each set is re-matched to provide a double-check on adherence to requirements.

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Mine Water *(Continued)*

"This entire mine would have been lost but for the resourcefulness of the technical staff. To stem this flood, deep-sea divers, working in over 80 ft of water, constructed a concrete bulkhead which sealed off the flow. Subsequently a pumping station was built, which today raises 6,800 gal of water out of the shaft every minute.

"For eight years a serious drought had nearly eliminated farming in the area. Both the small farms and large holdings were becoming dangerously non-productive. The town of Aquiles Serdan was gradually losing its population.

"The pumping station at San Antonio has not only made it possible to continue the use of the mine, but has supplied the people of the valley with water for drinking, washing and irrigation."

The news letter commented that material for the article was furnished by M. C. Hirtzel, superintendent of the Santa Eulalia Unit for 15 yr.

Maine Puts Out New Geological Map Set

ON FEB. 12, the Maine Geological Survey will release its GP&G Survey No. 1, "An Aeromagnetic and Geologic Reconnaissance Survey of Portions of Hancock and Penobscot Counties," in a set of 10 map sheets, including base, geologic and aeromagnetic maps and profiles plus one sheet containing legend and descriptive information. Survey sheets sets are available by mail from John R. Rand, Stat geologist, Department of Economic Development, State Office Building, Augusta, Me.

Vitro Converts To Solvent Extraction

A $1.2-MILLION expansion program, calling for conversion to the solvent extraction uranium recovery technique which in turn will boost plant output to 660 tpd, was recently announced by Vitro Uranium Co.

William B. Hall, Vitro president, also stated that James D. Moore, chief process engineer, had been made Vitro Uranium's production manager. Moore, who joined Vitro as a chemical engineer in 1951, will now be responsible for all plant operation, engineering, maintainance, and process research and development.

IN THE U. S.

ARIZONA

Arizona's 1957 mineral production value (not including uranium) took a decided drop (25%) from $479.6-million in 1956 to $360.6-million in 1957. Because of a lower price during the year, copper fell $122.5-million while output was actually greater than the year before—U.S. Bur-

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STANDARD on the big-yardage projects . . .

Bucyrus-Erie walking draglines

Producers everywhere have learned from long experience that Bucyrus-Erie walking draglines set the standard for dependable, low-cost handling of multi-million-yard mining operations.

The unit shown above, owned by Davison Chemical Co., Division of W. R. Grace and Co., Bartow, Fla., is one of many Bucyrus-Erie walking draglines working in Florida phosphate fields. They set the standard there for dependability, with simple, proved design and strong construction throughout. They set the standard for big output and economy with exclusive Bucyrus-Erie walking mechanism that makes move-ups smooth and accurate . . . with strong front end that reduces deadweight, permits applying maximum power to swinging payloads . . . and with Ward Leonard variable-voltage control that provides faster acceleration and deceleration than is possible with any other type of control.

If your operations require handling big yardages, let us tell you more about the proved dependability and economy built into Bucyrus-Erie walking draglines—4 to 34-cu. yd. capacities.

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WEIGHING AND RECORDING
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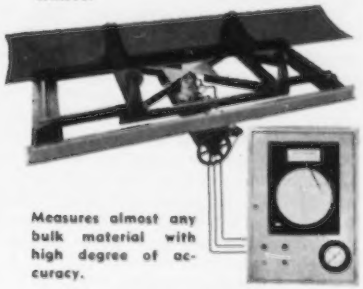
Con-O-Weigh

The Con-O-Weigh System offers an entirely new concept in continuous-belt-conveyor weighing — thoroughly job-proven as a control system in industries with problems in feeding, weighing, blending and totalizing of free flowing bulk materials. Consisting of only three major parts — the weigh section, load cell and recording-totalizing unit — Con-O-Weigh features rugged construction and simplicity of design, insuring economical installation and minimum maintenance.



Measures almost any bulk material with high degree of accuracy.

No obstruction above belt . . . complete weigh mechanism placed under the belt.

Design prevents inaccurate torsional pressures, thus eliminating errors resulting from uneven belt loading.

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Arizona *(Continued)*

eau of Mine's preliminary report.

	1957	1956
Copper (short tons)	**512,600**	505,908
Gold (troy oz)	**157,300**	146,110
Gypsum (crude) (short tons)	**80,400**	95,666
Lead (short tons)	**12,500**	11,999
Lime (short tons)	**136,700**	126,876
Manganese ore and conc. (35% or more Mn)	**76,900**	42,008
Molybdenum (in ore and conc.) (thousand lb)	**2,370**	2,392
Perlite (crude) (short tons)	**1,300**	15,928
Pumice (short tons)	**113,400**	114,609
Sand & gravel (short tons)	**8,000,000**	7,932,500
Silver (troy oz)	**5,336,000**	5,179,185
Stone (short tons)	**1,670,000**	1,623,029
Tungsten conc. (short tons) (60% WO)	3	186
Zinc (short tons)	**33,300**	25,580

CALIFORNIA

California's bulging 1957 mineral production ($1,631,405,500 compared with $1,555,267,000 in 1956) was attributed to the advance in the average unit price for crude petroleum, despite a drop in the value of oil produced, according to the annual U.S. Bureau of Mine's preliminary report.

	1957	1956
Boron minerals (B_2O_3 content) (short tons)	**308,000**	315,047
Cement (376 lb bbl)	**35,000,000**	39,289,586
Chromite (short tons)	**32,000**	27,082
Clays (short tons)	**3,100,000**	2,981,595
Copper (short tons)	**830**	859
Gold (fine oz)	**166,700**	193,816
Gypsum (short tons)	**1,349,000**	1,399,390
Lead (short tons)	**3,640**	9,296
Lime (short tons)	**336,000**	302,479
Manganese ore (35% or more Mn)* (short tons)	**14,300**	6,595
Mercury (76 lb flasks)	**14,250**	9,017
Perlite (short tons)	**15,200**	15,119
Pumice, pumicite, and volcanic cinder (short tons)	**600,000**	634,356
Salt (common) (short tons)	**1,480,000**	1,444,211
Sand & gravel (short tons)	**71,000,000**	86,525,955
Silver (fine oz)	**515,000**	938,139
Stone (short tons)	**29,500,000**	32,583,370
Talc, pyrophylite, and soapstone (short tons)	**146,000**	153,710
Tungsten conc. (60% WO_3) (short tons)	**2,700**	3,719
Zinc (short tons)	**2,980**	8,049
Iron ore (usable) (long tons)	**2,470,000**	2,414,277

* Excludes shipments to Government

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EXTREMULTUS is the revolutionary new power transmission belting that combines the shock absorbing properties of an elastic, incredibly strong core of polymer with the unexcelled friction surface of specially chrome tanned leather. In addition to absorbing shock and vibration, EXTREMULTUS will not stretch on fixed centers, runs at speeds over 10,000 feet per minute, and carries loads up to 6,000 H.P.! Write today for descriptive catalog.

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California *(Continued)*

low-grade depots and custom mills, but quantity and value for this material is as follows: 1955—manganese ore, 4,244 short tons, $292,637, and manganiferous ore, 18,395 short tons, $638,651; 1956—manganese ore, 293 short tons, $19,630.

California uranium miners are looking to experiments in upgrading to make operations profitable enough to justify establishment of a uranium mill. California uranium ore must be shipped out of the state for processing, adding greatly to the cost of operations. All or most uranium operations have closed down. Many operators feel that if they had a mill nearby, their not-top-grade ore would be profitable.

Uranium upgrading experiments have been conducted for several weeks by Arthur G. Dearing of Greenville, Ohio. Initial operations at Inyokern take place in what used to be a crusher and mill of a tungsten plant. Then the ore is mechanically and electronically treated, according to reports.

Construction will get under way next June or July on the $1,226,000 center the U.S. Geological Survey will build in Menlo Park. That means the staff of 350-400 will be able to move into the new facility by summer of 1959. Staff now headquartered at Sacramento will be transferred.

New quarters are designed to handle a topographic program 20% larger than the present program, but it hasn't been decided whether the increased capacity will be fully exploited at the outset. If the program is enlarged it will mean the office will cover the same territory (nine western states) but it will step up its activity in that area.

Surface rights determination work has started in Tulare County in an area near Kern River and extending from Needles Lookout to a point three miles south of Fairview. When this work is completed, surface rights determination will be conducted in the Kern River Canyon from Democrat Springs downstream to the Sequoia National Forest boundary at mouth of canyon, forest supervisor Eldon Ball announced.

Surveys are carried out in accordance with the Multiple Use Mining Act passed by Congress in 1955. Known as Public Law 167, the act provides Government with a procedure by which abandoned, inactive invalid and unidentifiable claims located prior to the act may be brought under the category of a claim located subsequent to the act.

Nothing in the act affects the mineral rights of any mining claimant, nor does it prevent a mining claimant from obtaining patent under the mining laws of the U.S., Ball notes. The act does not permit the elimination or cancellation of any mining claim. It simply enables the Government to carry on a multiple land use program and at the same time protects the rights of miners to prospect for and develop mines.

Cruising rangers determine who, if anyone, is in possession of claims. When reached, claimants are notified that a determination of rights is being made. At this point claimants have the choice of doing three things: (1) Ignoring the notice. This will give the service the right to manage surface resources of claims; (2) Relinquish all surface rights which are contrary to those the government has on claims filed after 1955; (3) File a statement asserting a claim validity predating passage of the law. This will be examined by an expert and if the validity is questioned by him, a hearing will be held before the Bureau of Land Management.

Mineral materials are made available to all who need them, the legitimate miner retains all of his mining rights and the responsible Government agencies are authorized to manage surface resources in the public interest, Ball notes.

There have been many reported instances of so-called "miners" using Government land as private recreation grounds.

Public Law 167 amends the act of July 31, 1947 (61 Stat. 681) to crack down on people illegally using surface rights.

Borates and other non-metallic minerals have touched off a new mining boom in the Mojave Desert.

Among operators entering the desert are Kern County Land Co., M. E.

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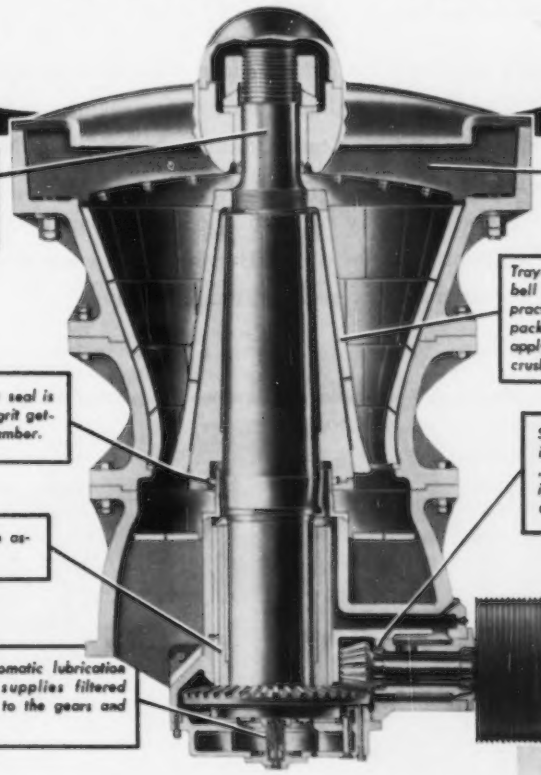

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Straight line bar type cast steel spider has an extra heavy hub. Simple but strong.

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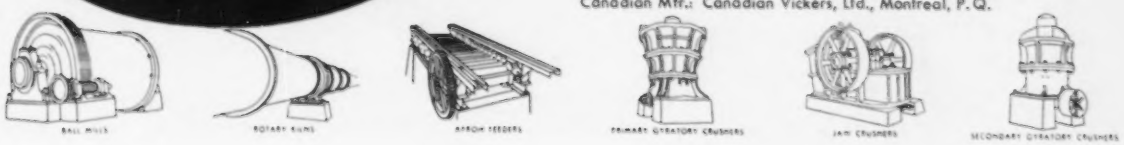

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- **with longer equipment life,**
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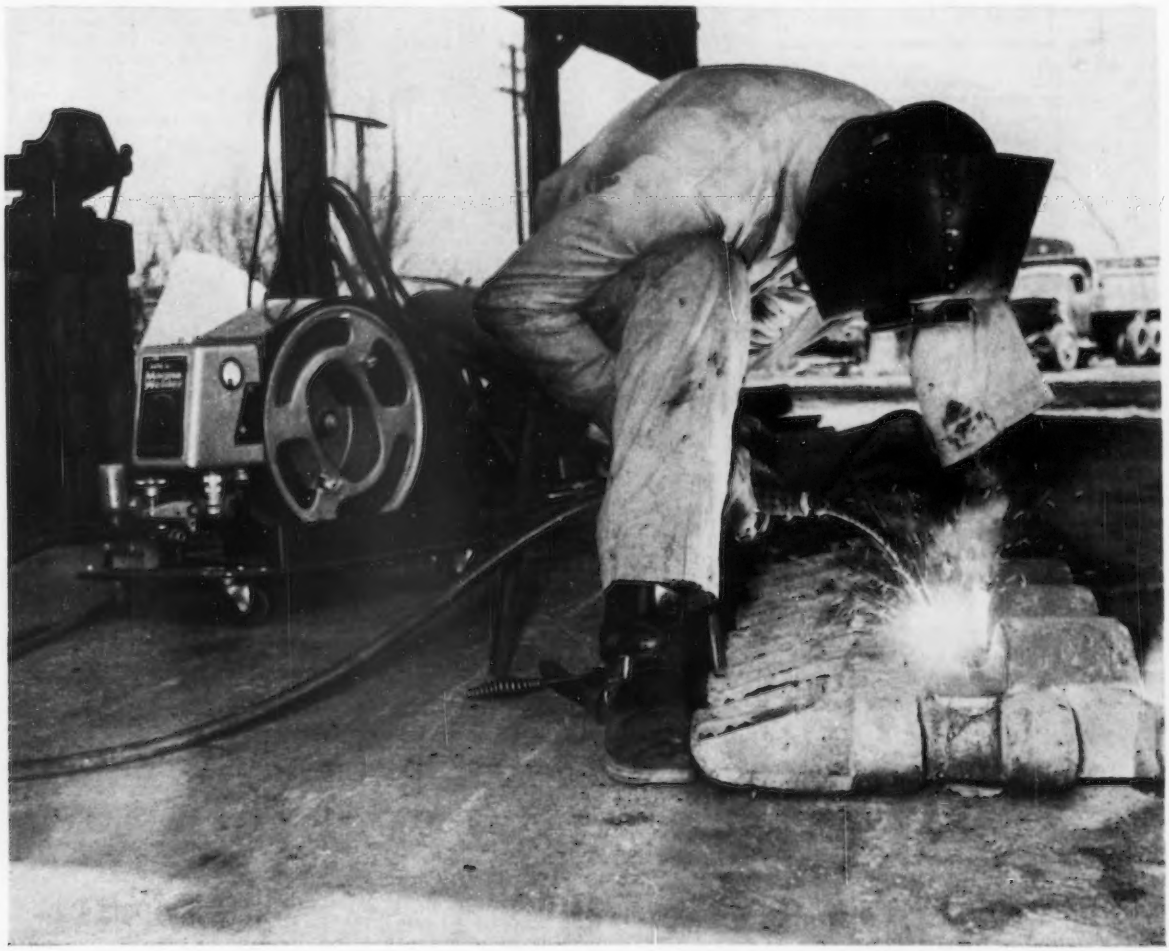
- **faster, easier reclamation of worn equipment!**

Everyone is always searching for *better, easier ways* to keep equipment in operation! Until the development of Stoody semi-automatic wires, maintenance hard-facing was limited to manual welding or fully automatic welding. Now, however, operators have a new tool which combines the advantages of *both* the manual and automatic processes with extreme flexibility of application. Hard-facing is usually applied directly without need for dismantling or positioning equipment. Speed of the process surpasses even automatic welding.

Weldor rebuilds shovel track pads with semi-automatic machine using Stoody Nickel Manganese wire to restore lost metal.



Facing Pays Off...

CONTINUOUS WELDING—Stoody semi-automatic wires are fed through any semi-automatic welder. Welding is continuous, without wasted stub ends or constant changing of electrodes. The wires are clean, bright, drawn to exact size and specially annealed for trouble-free feeding. Chemically coated papers prevent rusting in shipment.

COMPLETE WELD VISIBILITY—With open arc welding you see the weld as it is applied—vision is not hampered since most wires are fed bare. This means accurate welding and greater ease when working along edges or welding to a line.

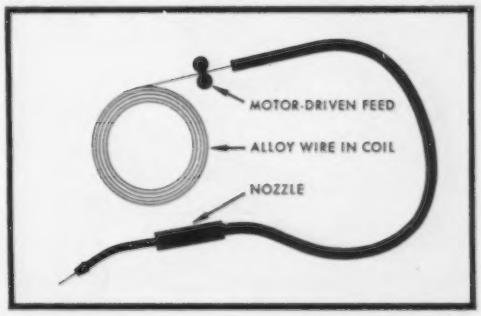
FASTER APPLICATION—High current density makes it possible to apply more pounds per hour. Usually the semi-automatic increases welding speed from 2 to 4 times! Lets you do those welding jobs that you've been putting off for lack of time.

HELPS ELIMINATE RUSH WORK—Faster application reduces the pile-up of work, takes the strain off your welding crew. Jobs go through smoother and easier. Rapid wearing equipment can be touched up during off time or between shifts.

EXCELLENT WEAR RESISTANCE—Stoody semi-automatic hard-facing wires are equal or superior in wear resistance to well-known Stoody manual electrodes of similar analysis. Low penetration causes less dilution with the base metal, therefore deposits are higher in alloy content, improving over-all wear resistance.

WIDE RANGE OF WIRES in low alloy to high alloy types gives you the only complete selection on the market, provides the one "best" wire for each wear condition... your assurance of *maximum protection per dollar invested!*

ASK FOR A SEMI-AUTOMATIC DEMONSTRATION! Our field engineers are equipped to demonstrate this new time, cost and labor saver right on your job. Arrange a date with your Stoody dealer! (Check the "Yellow Pages" or write direct.)



HOW SEMI-AUTOMATIC HARD-FACING WORKS Stoody semi-automatic wires are fed through the machine by motor-driven rolls. The motor is automatically actuated as the arc is struck. The weldor merely directs the deposit; wire feed is automatic and continuous as long as the arc is maintained. Certain wires are best applied by submerged arc, using the semi-automatic machine with a light positioner for full automatic welding.

Rebuilding tamps with semi-automatic machine. Pipe section is driven over worn feet, filled with Stoody 121. Cost is one-third of ordinary replacements... service life several times more.

Bucket lips, teeth and sides are hard-faced with semi-automatic welder without positioning work. Stoody 121 is generally recommended for position welding, as on bucket sides.

Impact breakers are readily hard-faced in position with the semi-automatic. Frequent applications are often necessary to maintain efficiency of crusher. Speed of application is important here.

Tooth from 5-yard bucket... repointer welded with Stoody Nickel Manganese and hard-faced with Stoody 121 by the semi-automatic process.

Carrying scraper blades, cutters and sides are most economically protected by use of the semi-automatic welder using Stoody 100 or Stoody 121.

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APRIL 15-17, 1958

This New
RIDGID 4PJ
is the only 2½" to 4"
geared threader that's
Jam-Proof

It's safe—can't jam and knock equipment around when you thread pipe by power drive. Automatically kicks out after standard thread is cut. Workholder sets to size *before* putting on pipe — other easier work features. See it at your Supply House!

The Ridge Tool Company, Elyria, Ohio, U. S. A.

California (*Continued*)

Frazier of Los Angeles, Finley Co. of South Houston, Tex., and Kerr-McGee Oil Industries. Kern County Land Co. has leased acreage in the Kramer mining district northeast of Boron. M. E. Frazier and Finley Co. have leased two placer claims totalling 180 acres three miles north of Boron. Kerr-McGee signed up 14,885 acres in Kern and San Bernadino Counties, and agreed to pay $1 per year per acre for the 25-year term of the lease which includes rights to salines and other evaporates.

Reese & Hughes, mine operators, have opened up a large deposit of crystalline graphite in the Mojave Desert, 15 miles northeast of Palmdale, Calif. Reserves are estimated to be high grade.

American Potash & Chemical Corp. has completed arrangements to conduct exploratory investigations of manganese ore deposits at Batesville, according to an announcement by Peter Colefax, president.

Deposits are located in 10,700 acres of land near Batesville, approximately 100 miles northeast of Little Rock. Mineral rights are held by four Arkansas companies: U. S. Manganese Corp., Arkansas Mining & Exploration Co., Miller-Lipp Corp., and Miller-McGee Manganese Corp.

If exploration results are favorable, a new company, 55% controlled by American Potash, will be formed to undertake production of the ore.

COLORADO

State's mineral production in 1957 (exclusive of uranium) continued to climb and marked the eleventh successive year of increases, according to the Bureau of Mine's annual preliminary figures. The Bureau reports, however, that total value of $325.2-million was only 5% above 1956.

	1957	1956
Beryllium conc. (short tons)	**144**	179
Clays (short tons)	**550,000**	522,573
Copper (short tons)	**5,200**	4,228
Feldspar (crude) (long tons)	**44,000**	47,014
Gold (troy oz)	**88,200**	97,668
Gypsum (crude) (short tons)	**74,000**	88,026
Lead (short tons)	**21,000**	19,856
Pumice (short tons)	**23,400**	50,015
Rare-earth minerals (lb)	**34,700**	32,145
Sand & gravel (short tons)	**16,000,000**	15,152,000
Silver (troy oz)	**2,834,000**	2,284,701
Vanadium (lb)	**5,254,500**	5,582,484
Zinc (short tons)	**46,200**	40,246

Uranium production during the 1957 fiscal year (July 1, 1956-June 30, 1957) was reported from 496 mines in 19 counties. Major producing counties continued to be Montrose, Mesa and San Miguel. According to data supplied by the AEC, production from Colorado

Thermoid Conveyor Belting ...pays on the long haul!

Here's belting with real stamina! Belt carcass and cover are welded together by Thermoid's exclusive impregnation process. With Thermoid's specially woven, finest quality reinforcement it troughs easily, withstands shock loading as no ordinary belt can—yet it is flexible enough to avoid internal heat build-up. The results of this unusual combination are years and years of trouble-free service on the toughest jobs.

There's a Thermoid Conveyor Belt made expressly for your materials handling requirements. For example: *Thermoid HT* for extremely abrasive materials such as quartz ores, trap rock and coal . . . *Thermoid A* for highly abrasive materials such as slag, lime, rock, ore, ashes, hot cement and crushed stone . . . *Thermoid C* for moderate abrasives such as sand, loam, gravel.

Your Thermoid distributor will help you select the conveyor belt that's exactly right for your needs.

Cut costs with Thermoid Multi V-Belts . . .

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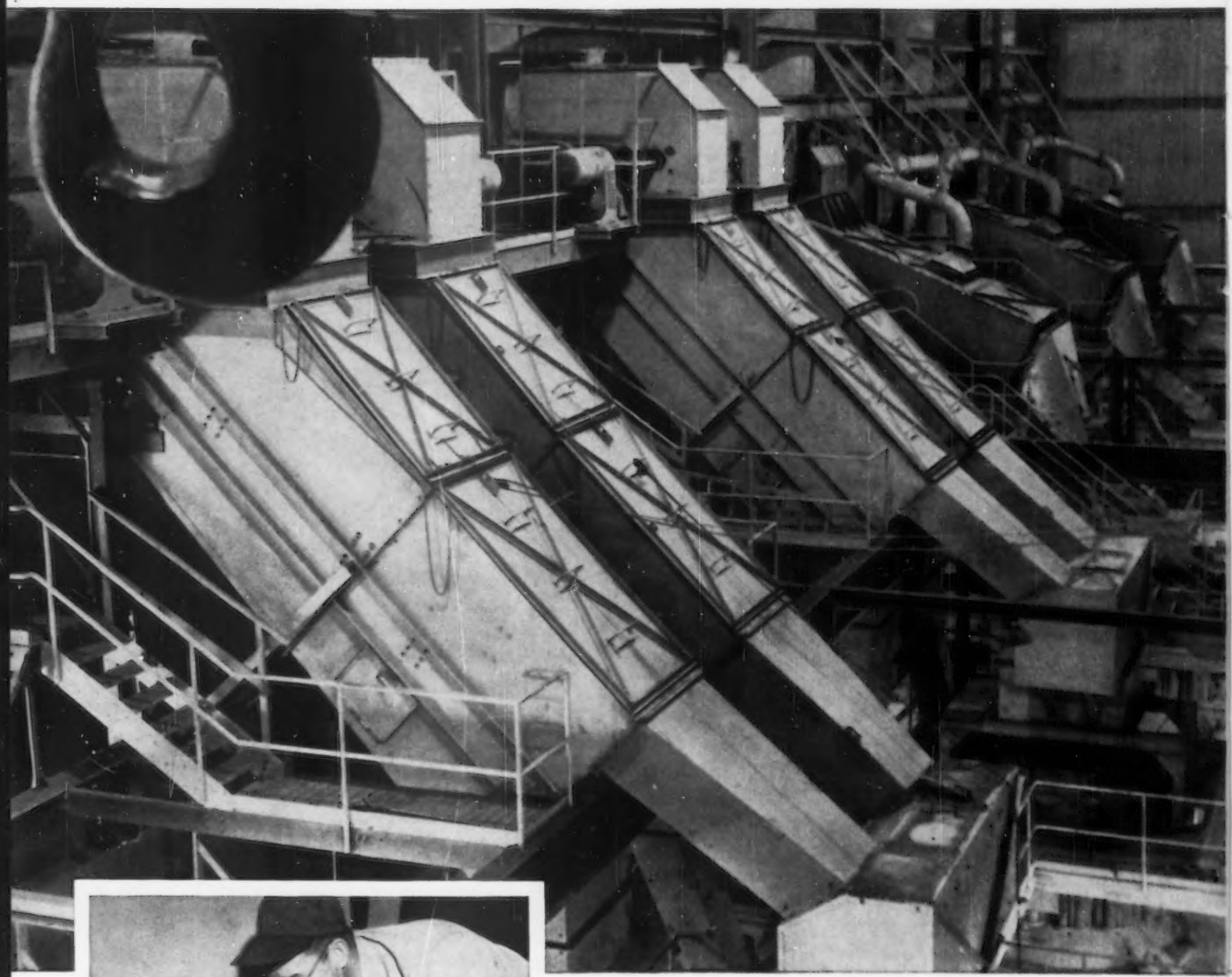
AT WHITE PINE COPPER MINE

USS "T-1" Steel consistently



*Feeder chute liners last 2 to 3 times longer

Hard and flinty copper ore plays hob with ordinary materials. That's why virtually all the feeder and transfer chutes in White Pine's crushing plant are now lined with USS "T-1" Steel. Quenched and tempered to 321 minimum Brinell, USS "T-1" Steel liners, ⅜" thick, have proved far longer-lasting than materials formerly used—give from 2 to 3 times longer service. These "T-1" Steel liners are easy to fabricate, are readily flame-cut to size—a great advantage over cast, anti-abrasive materials.

Also available from United States Steel—our well-known USS High Strength Steels, for many years standards for mining and ore handling equipment.

USS

outperforms other materials

Provides very high resistance to impact abrasion plus superior strength and toughness that keeps equipment in service far longer than before*

WHITE PINE COPPER'S experience with USS "T-1" Steel is typical of the improvements in service that this remarkable steel makes possible.

Wherever they have used it to replace former construction, equipment life has been materially increased. Repair and maintenance costs have been cut. Down time has been reduced. All this means important savings in time and money—savings that are far greater than the difference in initial steel cost.

USS "T-1" Steel is unique. There's never been another commercial alloy plate steel just like it. None better able to stand up to the brutal abuse inflicted on mining equipment . . . and as readily handled in fabrication . . . *and* so economical on the basis of performance.

*Loader plates last 8 to 12 months longer

At White Pine Copper, USS "T-1" Steel, supplied to 321 minimum Brinell, is used in the bottom and side plates of the conveyor of this loading machine. Also, in the plates on its underside along which the returning conveyor chain slides. Prime requirements here are toughness and high resistance to impact abrasion. Every one of these underground loaders has been overhauled since the mine was opened and, in every case, USS "T-1" Steel has been used to increase durability. The result—8 to 12 months more service life.

Here's why USS "T-1" Steel can help you improve your equipment

When you want strength far beyond the ordinary, you can get it with USS "T-1" Steel—for, with a minimum yield strength of 90,000 psi and a minimum tensile strength of 105,000 psi, USS "T-1" Steel is nearly three times as strong as structural carbon steel. This is far higher yield strength than has ever before been available in weldable plate steel. What's more, its strength is not lowered by welding or gas cutting.

For equipment subject to impact abrasion, USS "T-1" Steel can be obtained quenched and tempered to a minimum hardness of 321 Brinell. Even this very hard grade can be welded and flame-cut *right in the field* without preheating. That means you don't have to shut down costly, big-capacity equipment for the many hours generally required for shop repairs.

If your equipment must withstand severe impact abuse, USS "T-1" Steel insures against damage in winter weather. Whether furnished to 321 minimum Brinell or to 90,000 psi minimum yield strength, it has exceptional toughness and resistance to brittle failure, even at temperatures far below zero.

Our new catalog—USS "T-1"—is complete with technical information and offers many practical suggestions for its use that can save *you* money. For your free copy, write to United States Steel Corporation, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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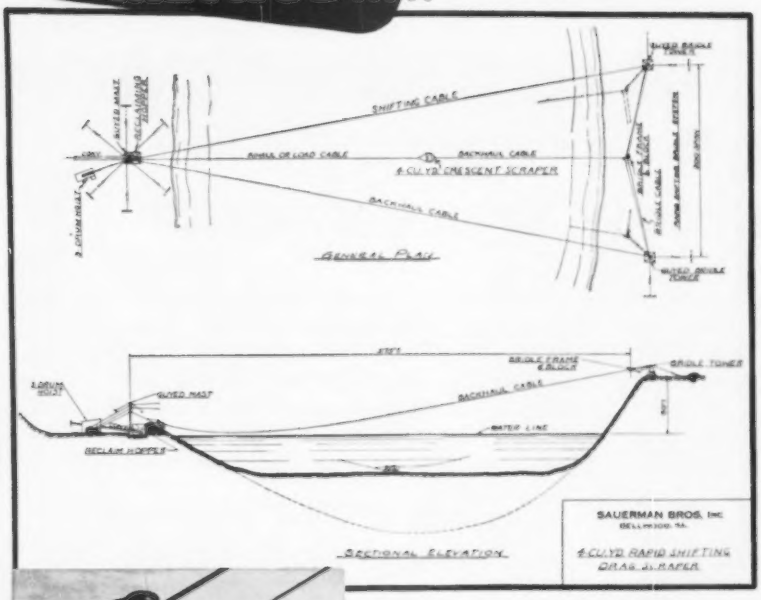
UNITED STATES STEEL

the SAUERMAN METHOD.....

Scraper Machines Engineered to Your Operation



Above drawing was prepared for a specific drag scraper installation and does not represent maximum spans.

View shows rapid shifting bridle frame and all operating cables. Crescent may be seen in background conveying load to reclaiming hopper just in front of mast.

•

Contact Sauerman's engineering department for specific recommendations and information. No obligation.

Ask for Catalog A, Drag Scrapers—24 pages of job photos and specifications. Request Field Reports showing your material being handled by the low cost Sauerman Method.

The Sauerman Method works equally well over widely differing areas and span limits . . . on hills, swampy ground or underwater . . . handles any material a dragline can dig.

Every scraper machine is powered by a Sauerman Roller Bearing Hoist, especially designed to withstand sudden shocks and changes in speed.

When a rapid shifter is used, a third hoist drum is added to shift the bridle frame. The rapid-shifting bridle system (upper right of drawing) permits frequent shifting of the scraper's line of operation in non-caving material, shallow excavations or overburden.

Operating costs are lower—basically, it is cheaper to drag material than it is to lift and transport it. You eliminate the power costs of moving heavy machinery about the area. You pay only for pay loads—not dead weight. When expendable parts—sheaves, clutch or brake linings—are replaced, the machine is restored to practically new condition.

Sauerman can help you select the method of materials handling most profitable for your job—a system that will give you the lowest cost per cu. yd. handled.

SAUERMAN BROS. INC.

626 S. 28th AVE. BELLWOOD, ILL.

Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks

Colorado *(Continued)*

mines during the period was 596,972 tons of ore containing 3,386,773 lb of uranium oxide and was 18% of the national total.

Gold receipts at the Denver Mint last November totalled 59,504 oz worth $2,082,653 compared with 57,773 oz worth $2,022,082 in November 1956, mint officials report. Silver receipts were up to 16,399 oz valued at $14,819 from 14,249 oz worth $12,908.

Officials of three uranium mining firms had a conference with AEC officials in Grand Junction to discuss plans for construction of a mill that will introduce new reduction and extraction processes of ore to the end-product desired by the U.S. Government. Process will operate on a new electrolytic principle, and mill construction will be a joint venture of Yucca & American Milling Corp.

Combination for unlocking America's great reserves of oil, held within the shale deposits in the Rocky Mountain areas of Colorado and Utah has been found, operators say. Union Oil Co. of California advanced the capital for necessary experimental work. The company had technical assistance of Denver's Stearns-Roger Manufacturing Co. in devising mechanical equipment for extracting oil from the raw shale, officials reported.

Continuing its $34-million expansion program which had already produced a record output of 31,000 tons of raw molybdenum ore per day, Climax Molybdenum Co. at Climax, has once again hiked its production by 3,500 tpd with the installation of a complete new ball-mill unit, powered, driven and controlled by system-engineered equipment.

A dividend of seven cents per share upon the outstanding fifty-cent par value stock was declared by the Rico Argentine Mining Co. of Rico in the San Juan.

A chairman of a uranium mining company has urged experts to stop deriding and discouraging amateurs from searching for atomic ore. "Instead," said Gerald Gidwitz of Chicago, "we should encourage all prospectors, including weekend wildcatters, picknickers and vacationists with geiger counters, to find this basic military and industrial material." Gidwitz based his opinion on the fact that the U.S. has only a 10-year reserve of uranium, according to official Government reports.

Vanadium Corporation of America was to close its Naturita, mill in late February, D. W. Viles, vice president at Durango of VCA told *E&MJ*.

Some 125 persons are employed at the mill—one of the oldest on the Colorado Plateau and in the domestic uranium industry.

Mr. Viles said that the 300 tpd mill is being closed because it cannot operate profitably at present level of concentrates purchase prices established in contracts by the AEC. Employees will be given jobs where possible at Durango mill of VCA and in VCA mines along Uravan mineral belt.

AN IMPORTANT MESSAGE

TO USERS OF EXPLOSIVES

American Cyanamid Explosives Now Serve You Nationwide and Market-Wide!

In a move to extend and broaden the range of our services to explosives users, American Cyanamid Company has purchased the plants, magazines and sales facilities of Illinois Powder Manufacturing Company.

Because of these expanded facilities, it is now possible for Cyanamid to serve you better...faster...with a wider range of dependable, *quality* explosives, electric blasting caps and blasting accessories.

Our sales representatives will welcome the opportunity to analyze and discuss your blasting problems.

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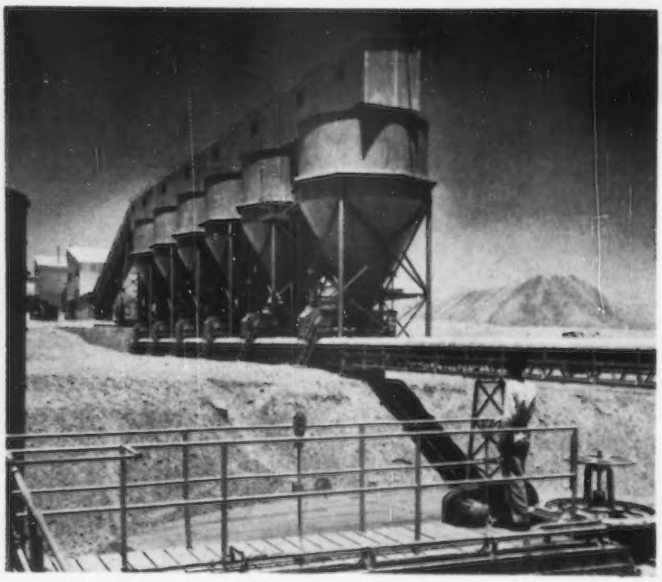

Blending . . . .

Ore blending is particularly important in some uranium concentration. Multiple storage and conveying designed and built by Stearns-Roger has met the requirements of this southwestern producer. For materials handling, as for other important operations in the processing of metallic or non-metallic ores, rely on the complete services of Stearns-Roger for design, engineering, fabrication or field erection.

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Stearns-Roger Engineering Company, Ltd., Calgary, Alberta

There is no substitute for experience . . .

Colorado (*Continued*)

AEC had been granting the Naturita mill extended contracts during negotiations concerning that concentrator. The commission also is in negotiation with VCA on extension of contracts at the Durango mill.

Mr. Viles said VCA would maintain an ore buying station at Naturita for service to independent shippers. The ore would go to the Durango mill.

Directors of Golden Cycle Corp. Colorado Springs, declared a 2½% stock dividend. One new share will be issued for each 40 shares held. Holders of fractional shares will be paid in cash at the rate of 40c a share. Golden Cycle paid two 15c dividends earlier in 1957, president Merrill E. Shoup said. Cash was being retained in view of the costs of the company's greatly expanding uranium activities.

IDAHO

Bureau of Mines reports that Idaho's mineral value declined about 2%, from $75.2-million in 1956 to $72.4-million in 1957, according to preliminary data. Copper and tungsten suffered the severest setbacks; copper value was $1-million less than in 1956 although tonnage produced increased from 6,656 tons to 7,555.

	1957	1956
Antimony (in conc.) (short tons)	**661**	549
Cobalt (in conc.) (lb)	**2,600,000**	2,385,013
Columbium-tantalum (oxide in conc.) (lb)	**350,000**	215,900
Copper (short tons)	**7,555**	6,656
Gold (fine oz)	**11,850**	9,210
Lead (short tons)	**70,225**	64,321
Mercury (76-lb flasks)	**2,200**	3,394
Nickel (in conc.) (lb)	**100,000**	98,495
Phosphatic rock (long tons)	**1,400,000**	1,438,151
Sand & gravel (short tons)	**7,500,000**	7,874,460
Silver (fine oz)	**15,148,900**	13,471,916
Titanium conc. (short tons)	**28,400**	48,619
Tungsten (short tons) (60% WO_3)	**38**	582
Zinc (short tons)	**58,642**	49,561

Dividend payments by Coeur d'Alene District companies during 1957 amounted to $3,567,647 as compared with previous year's $3,492,794 and an average of about $5,366,000 over the 10-year period, 1948-57. Ten companies made payments to stockholders last year as compared with seven in 1956. Bunker mill and Sunshine Mining, the two largest dividend payers, made lower payments in 1957 than in the previous year, but these reductions were offset largely by substantial increases from the Lucky Friday and Day Mines companies.

Salmon River Scheelite Corp. of Clay-

Coppus VENTAIR (centrifugal type)

Coppus VANO (propeller type)

Choose between them and get 30% to 100% more air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ⅓ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters *for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.*

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Idaho (*Continued*)

ton has subleased its tungsten mine in the Bayhorse District of Custer County to Robert M. Barrett of Salt Lake City under terms of a working agreement which requires Barrett to finance and operate the property after the $90,000 DMEA project now underway is completed. As part of the deal Barrett purchased company's remaining treasury shares, giving him a 20% stock interest in the corporation. First profits under Barrett's operation will be divided equally between operator and corporation until the latter has received $250,000. Thereafter, Salmon River Scheelite will receive 30% of net.

Silver Star, Queens Mines Inc., Blaine County, is currently working a crew of about 25 men on a three-shift schedule at its big property near Bellevue. Present development and mining operations are concentrated on the 600 and 640 levels of Queen vein, and preparations for sinking to the 900 level are now underway. Production during the first 11 months of 1957 totaled 4,400 tons with a gross value of $182,000.

Calera Mining Co.'s new open-pit on Blacktail Creek in Lemhi County's Big Creek drainage, which started production last September, is now yielding cobalt-copper ore at the rate of about 1,000 tpd. Pit operation, under contract to Isbell Construction Co., Reno, is on a two-shift basis, and current output is in excess of capacity of the 1,000-ton mill since the company is also mining from the same vein-type deposit by conventional underground methods.

Production at Bunker Hill Co.'s lead mine at Kellogg was cut back 16% effective Dec. 16 by reducing the work week from six to five days. On Jan. 1 the concentrator plant went from seven to five-day operation and the electrolytic zinc plant closed down one of its five units, reducing plant output by 20%.

Plans for drastic curtailment of expenditures for capital improvements during 1958 were also announced at year-end.

The curtailments, company officials said, were the result of continued low metal prices, growing inventories and lagging sales. They blamed "the increased flow of foreign imports at prices substantially below domestic quotations."

American Smelting and Refining Co. has stepped-up to a two-shift-per-day operation the new East Page exploration project on the 3,070-ft level of its Page Mine west of Kellogg. Started in October under a $660,206 contract with DMEA, the project will involve driving a 5720-ft "on-line" east lateral into the unexplored area between Page and Bunker Hill mines and some 7,000 ft of additional exploration work in that area. It's expected to take about five years to complete.

Merger plans involving Callahan Zinc-Lead Co. and its 62%-owned subsidiary, Vulcan Silver-Lead Corp., are currently under consideration by committees appointed by the boards of directors of both companies, according to Joseph T. Hall, president of both firms.

Closures of non-ferrous metals mines in Idaho was partially offset during 1957 with increased pace of non-metallic mining such as phosphates and clays, according to George A. McDowel, Idaho state mine inspector at Boise.

"Those nonferrous mines which closed last year were definitely victims of lower metal prices induced by excessive foreign imports", McDowel said. "For instance, after 17 years operations, the Truimph mine, a lead producer near Haily, closed down and made 111 men jobless."

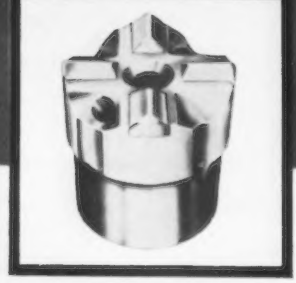
"The Ima mine near Patterson, a tungsten producer, closed through failure of Congress to continue appropriations for an authorized tungsten purchase program," he said. Some 100 men are out of work Mr. McDowel also added that: "cheap African cobalt production is putting the squeeze on the Calera Mining Co., now the largest cobalt producer in the western hemisphere."

ILLINOIS

Extension of the shaft at the old Parkinson mine, located on Grand Pierre

A TUNGSTEN CARBIDE INSERT BIT

Used to destruction without resharpening



PATENTS APPLIED FOR

LIDDICOAT

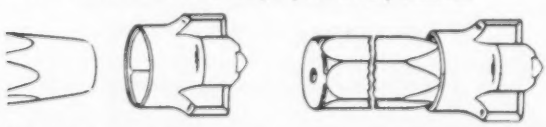
FOR ALL SIZES OF DRILL ROD—⅞" TO 1½"

UNIQUE DESIGN — FAST CUTTING ACTION

The Liddicoat Bit was developed as the answer to a long felt need for a tungsten carbide insert bit designed to give fast cutting performance . . . long cutting life . . . low initial cost . . . low cost per foot drilled. A bit that can be used to destruction and then discarded, thus eliminating costly labor and equipment necessary for resharpening. In the design are unique features which cannot be built into the conventional multi-use bit that has to be resharpened.

TAPER SOCKET — NO THREADS — FAST, FIRM ATTACHMENT

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.



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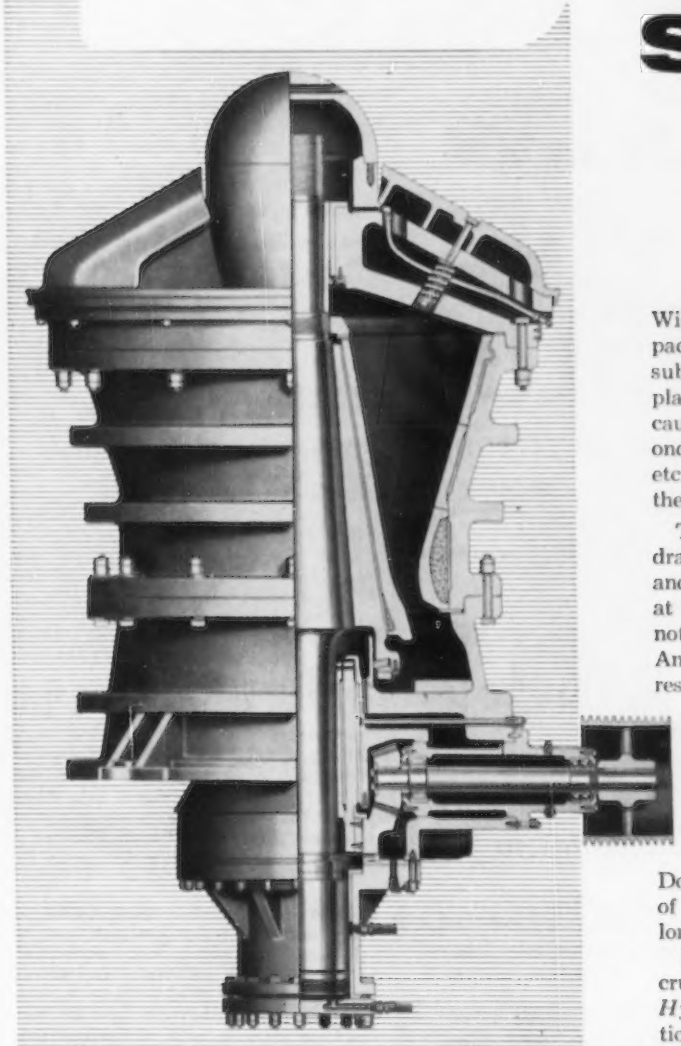
CRUSHER *with Hydroset mechanism*



Sets the pace

for your entire production circuit

With a *Superior* primary crusher setting the pace — *a fast pace* — you get the most out of subsequent equipment in your flow. Over-all plant operating costs are kept at a minimum because the entire circuit remains in balance. Secondary and tertiary crushers, vibrating screens, etc., may be utilized in sizes and types to meet the requirements of a constant tonnage.

The secret is in the *Hydroset* control. This hydraulic adjustment maintains the initial setting and a uniform product by compensating for wear at the flip of a switch. Related equipment need not be readjusted to meet variations in feed size. And — if the *Superior* crusher stops under load, restarting is facilitated by *Hydroset* control.

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Hydroset

mechanism reduces maintenance

Downward thrust, gyrating and rotating motion of mainshaft are carried on efficient, oil-cooled, long-wearing step bearings.

Remember, only an Allis-Chalmers gyratory crusher offers the profit-building advantages of *Hydroset* mechanism. For complete information, see your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

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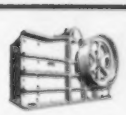
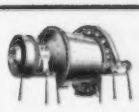
A-5323

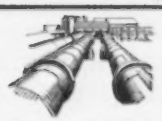
Hammermills

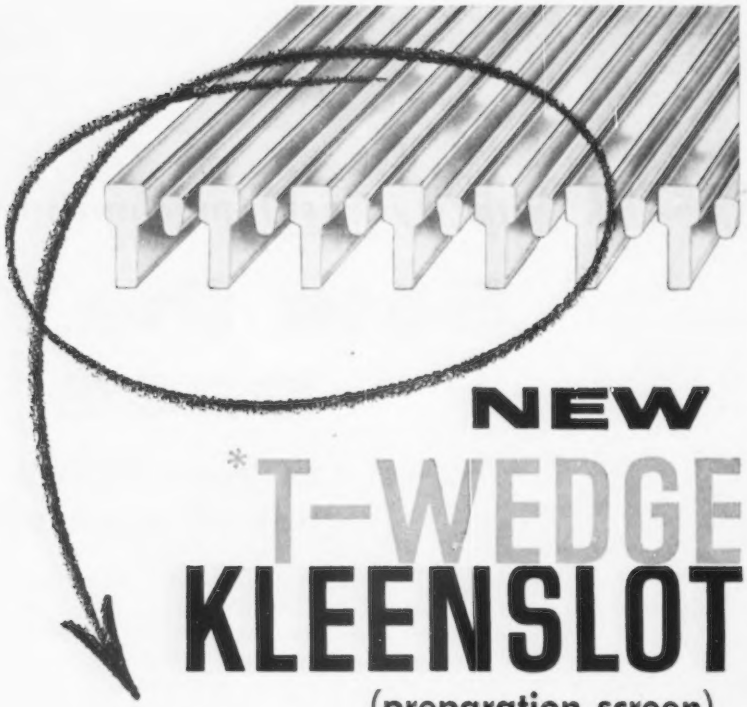
Vibrating Screens


Jaw Crushers

Gyratory Crushers


Grinding Mills


Kilns, Coolers, Dryers

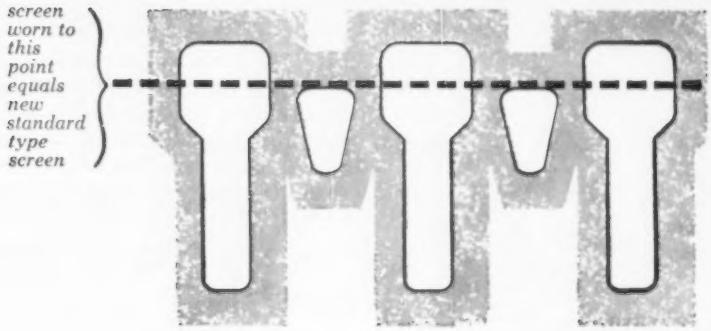


NEW

*T-WEDGE

KLEENSLOT

(preparation screen)



"T" and "WEDGE" wire combine to create the ultimate in...

GUARD BAR DESIGN – high "T" profile wire between every wedge shaped wire performs as guard bar *and* screen

GUARD BAR ECONOMY – new design effects added screening surface, small screen efficiency with large screen life

with *I.F.A. *independent flexing action for non-blinding, non-clogging performance*

new T-WEDGE screen is especially adaptable for flumes or vibrator applications—can be easily interchanged with other types of Kleenslot screens without mechanical changes—abrasion resistant stainless steel

FOR ADDITIONAL INFORMATION . . . write

WEDGE-WIRE CORPORATION
Wellington, Ohio

*patent applied for

Illinois (*Continued*)

Creek, Hardin County, has been started by Ozark-Mahoning Co., according to Arthur G. Johnson, vice president and general manager. Extension will be from 180 to 400 ft. Parkinson property, shut down for the last four years, is among the oldest in the entire fluorspar mining district—first operation began in 1870.

Rosiclare Lead and Fluorspar Mining Co. will resume mining on its Hardin County property. Company had been shut down since March 1954 following sharp fluorspar price reductions.

Wiley Cochran, M. L. Conn and Ted Joiner, independent mining operators with offices in Elizabethtown, have negotiated and received mining leases on company's mining property. Mining operations and exploration work are expected to start in the very near future.

Jack Nesheim, geologist, of Milwaukee, Wis., representing Kaiser Aluminum Co., is making exploration surveys in the Illinois mining district with headquarters at Eldorado.

MICHIGAN

For the first time, all iron ore shipments from Ashland this last season were handled on one dock, that of the Soo Line railway. The Chicago & North Western R.R. No. 3 timber dock was not used. Total shipments from Ashland—all from the Gogebic range—were 3,483,740 tons. Largest shippers were Montreal mine of Oglebay, Norton & Co., 929,110 tons, and the Mauthe group operated by Pickands, Mather & Co. with 613,249 tons.

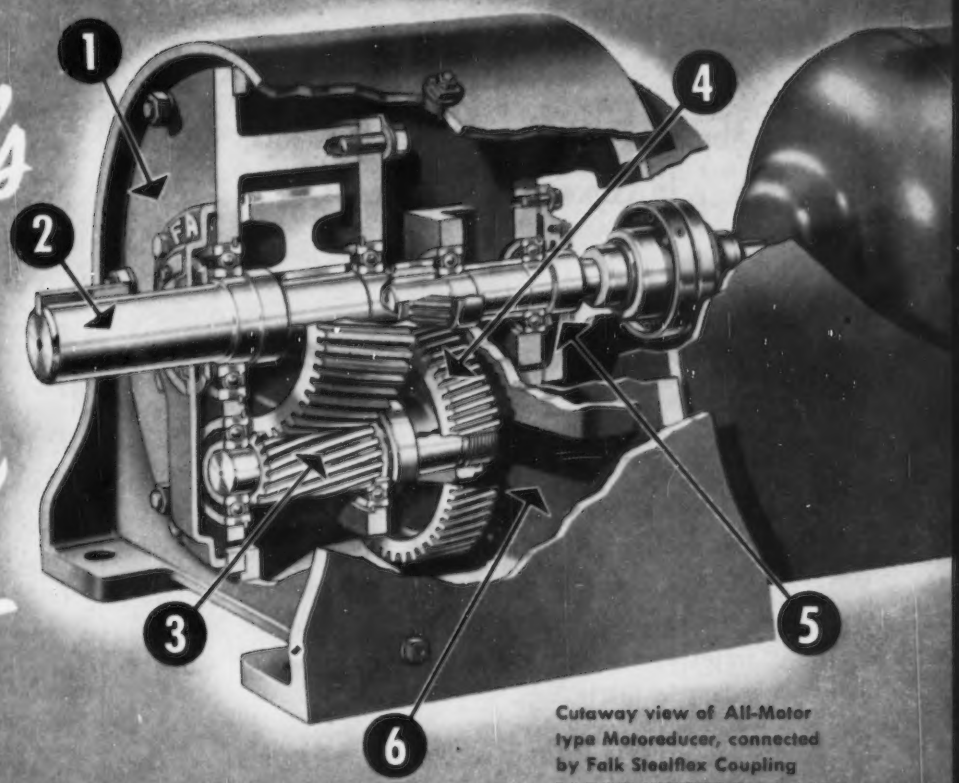
Report of the Iron county mine inspector shows that 13 mines employing 1,883 men operated on the Menominee range during 1957. Two fatal accidents were reported. Companies which shipped from the range were: M.A. Hanna Co., Inland Steel Co., North Range Mining Co., Republic Steel Corp., Verona Mining Co. and Cleveland-Cliffs Iron Co., from the Spies stock-pile.

United States Metals Refining Co. of the American Metal Co. has completed its year-long diamond drilling exploration 17 miles north of Wakefield with a total of 132,000 ft of drilling. A large deposit of copper bearing shale has been outlined showing over 100-million tons averaging better than 1¼% copper.

Marquette Iron Mining Co. has completed a diamond drilling program at the Empire property near Negaunee. Empire is a low grade iron material leased by Marquette. Company is owned and operated by Cleveland-Cliffs Iron Co. and co-owned by Jones & Laughlim Steel Corp., Wheeling Steel Corp., International Harvester Co. and Inland Steel Co.

Inland Lime and Stone Co. has instituted a "spread the work" plan under which the operation will be carried on 40 hours per week, while the men work 32 hours per week.

Here's the inside story—



Cutaway view of All-Motor type Motoreducer, connected by Falk Steelflex Coupling to standard NEMA frame motor

WHY Falk Motoreducers give better service—have longer life

Here is the "inside story" behind the all-steel All-Motor type FALK Motoreducer's universal reputation as a gear drive unmatched in quality, efficiency, dependability, ease of maintenance and long life. These "In-built" factors are—

1 **ALL-STEEL HOUSINGS.** Rugged, strong, rigid...all parts are manufactured from heavy steel plate, formed and welded in the Falk Weld Shop.

2 **LARGE OVERHUNG LOAD CAPACITY.** Large shafts, oversize bearings...rigid mountings with wide bearing spans to handle maximum applied loads.

3 **PRECISION GEARING.** Heat-treated alloy steel gearing, precision cut and shaved after heat treatment to eliminate distortion. Quiet, crown-shaved pinions.

4 **EXTRA-CAPACITY GEARING.** Special extra-capacity gear-tooth form with larger contact area gives greater strength, higher load-carrying capacity.

5 **SEALED HOUSINGS.** Splashproof, dustproof, oil-tight construction. Dual closures and one-way vents keep oil in, dust and moisture out.

6 **POSITIVE LUBRICATION.** Large sump capacity...oiltight construction assures clean lubricant...revolving elements lubricated by direct dip.

When you buy or specify the All-Motor type FALK Motoreducer, you get all these—plus the tremendous advantage of full interchangeability of motors. Switch motors as desired—use any make, style or type of standard foot-mounted motor within the unit's AGMA rating—with a minimum of difficulty or "down time."

Available in sizes up to 75 hp—*with or without motor*—from convenient factory, field or distributor stocks, from coast to coast. **Write for Bulletin 3100.**

60,000 HOURS WITHOUT A FAILURE!

Sixty thousand hours is a lot of hours—but the FALK Motoreducer in the unretouched photo above has served that long without failure or need of repair.

This 3 hp unit is one of over 60 FALK Motoreducers in daily service in an Eastern plant of a large milling company, whose president says, in part:

"One of the main advantages of FALK Motoreducers is their adaptability to any motor. Reducers and motors can be easily interchanged....Our service records confirm the wisdom of our choice of FALK equipment as our standard."

FALK...a good name in industry

THE FALK CORPORATION, MILWAUKEE, WISCONSIN

MANUFACTURERS OF

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Abreast Technological Developments In Concentrating Minerals

With all the scientific progress of a technological age, the SuperDuty® DIAGONAL-DECK® Concentrating Table is still supreme in its ability to deliver highest grade concentrates at low cost and with minimum loss of values to the tailings.

The reason for this is that the separating action is basically sound. The SuperDuty table separates the values by processing the pulp over a riffled deck where the heavy minerals are guided endwise to the discharge edge while the lighter gravity particles are carried over the riffles and away as worthless tailings.

Efficiency is unexcelled. Send for Bulletin 118-B

CONCENCO® Type "CPC" Classifier

This all steel Constriction Plate Classifier is available in 1 to 10 or more cells. Novel secondary classification sharpens the separations made by each main cell. Advantages offered are: (1) accurate classification or sharp sizing, (2) easy and effective hydraulic water regulation, (3) as many spigot products as there are cells, (4) continuous discharge, (5) no moving parts, (6) low maintenance cost.

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CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

Michigan *(Continued)*

Work was begun in January driving sheet piling on the west side of Ashland's Soo Line iron ore dock. Both sides of dock are scheduled to be dredged to a depth of 27 ft.

Lake Superior Mine Safety Council held a meeting in Negaunee Dec. 4.

Fred Michels, Negaunee, North Range Mining Co. safety director, talked on "Extinguishing a Mine Fire With CO_2." L. J. Zaverl, U. S. Bureau of Mines, gave a paper that he and Allen D. Look, also from USBM, Duluth, prepared on "Underground Metal Mine Fires From Cutting And Welding." William A. Hyde, assistant maintenance supt. at Oliver Iron Mining Division's Pilotac plant, Mountain Iron, Minn., talked on "Conveyor Belt Safety." The papers on mine fires were especially timely because of the underground fire less than one year ago at the Penokee mine, Ironwood. Oiva Hakala, Cleveland Cliffs Iron Co. mining engineer, delivered a paper on "Accidents by Handling Materials."

MINNESOTA

Total shipments of iron ore from U.S. ports on the Great Lakes for 1957 were 81,234,559 tons, compared to 73,389 972 tons in 1956. Including Canadian ports the corresponding figures were 84,614,734 tons and 77,633,027 tons. First boat of ore for the season, the L.E. Block, left Escanaba, Mich. on April 1 and the last was the Hagarty from Picton on December 4th.

Caland Ore Co., Inland Steel Co. subsidiary, has made good progress on its 1260 acre lease from Steep Rock Iron Mines. About one half of the estimated 182 million cu. yds. of silt has been dredged by Construction Aggregates of Chicago. Water level in Falls Bay has been lowered about 325 ft. An eight-compartmented, 15 ft 6 in x 21 ft 8 in. shaft, designed to serve the underground portion of the property, is down over 700 of its planned 1300 ft. Production is expected to begin in 1960.

Work on Erie Mining Co.'s new plant at Hoyt Lakes has progressed on schedule. Several units have been given test runs: primary and secondary crushers, some of the third and fourth stage crushers, several of the 27 sets of rod and ball mills in the concentration plant, some of the 24 furnaces and one of the two power plant generators. The others are nearing completion. These test runs will continue as work on the equipment advances, but it will be some time before the entire project—plant, mines, railroad and harbor—is completed.

New Hill-Annex mine (Jones & Laughlin Steel Corp.) tailings reclamation plant, for its first season, produced 147,756 tons of concentrates running 56.13% in iron. With the usual new plant difficulties practically all ironed-out, Hill-Annex is expected to produce 200,000

85,007 FT. OF 6½" HOLE IN 14 MONTHS

with "Jimmy" Diesel-powered Ingersoll-Rand Drillmaster

Want to get the most work out of your equipment? Then consider the experience of J. Robert Bazley, Inc., Pottsville, Pa., stripping contractor.

Bazley put his second General Motors Diesel-powered Drillmaster to work in 1956 and for several months this unit has operated three shifts a day. In its first 13 months, this machine drilled 74,620 ft. of 6½" hole. Bazley's first Drillmaster, now operating round the clock near Stockton, Pa., drilled 85,007 ft. in 14 months.

You get work done faster with equipment powered by GM Diesels because these rugged 2-cycle engines deliver a smoother, steadier flow of quick-accelerating power—in rotary air compressors; shovels or draglines; locomotives; scrapers or haulers. And as a bonus you get the high interchangeability of GM Diesel parts which cuts inventory requirements to a minimum. When you're in the market, be sure to ask for equipment powered by GM Detroit Diesel. It's money in your pocket!

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Now—more than ever—it pays to standardize on GM Diesel—available in 1485 applications of power equipment built by more than 175 manufacturers

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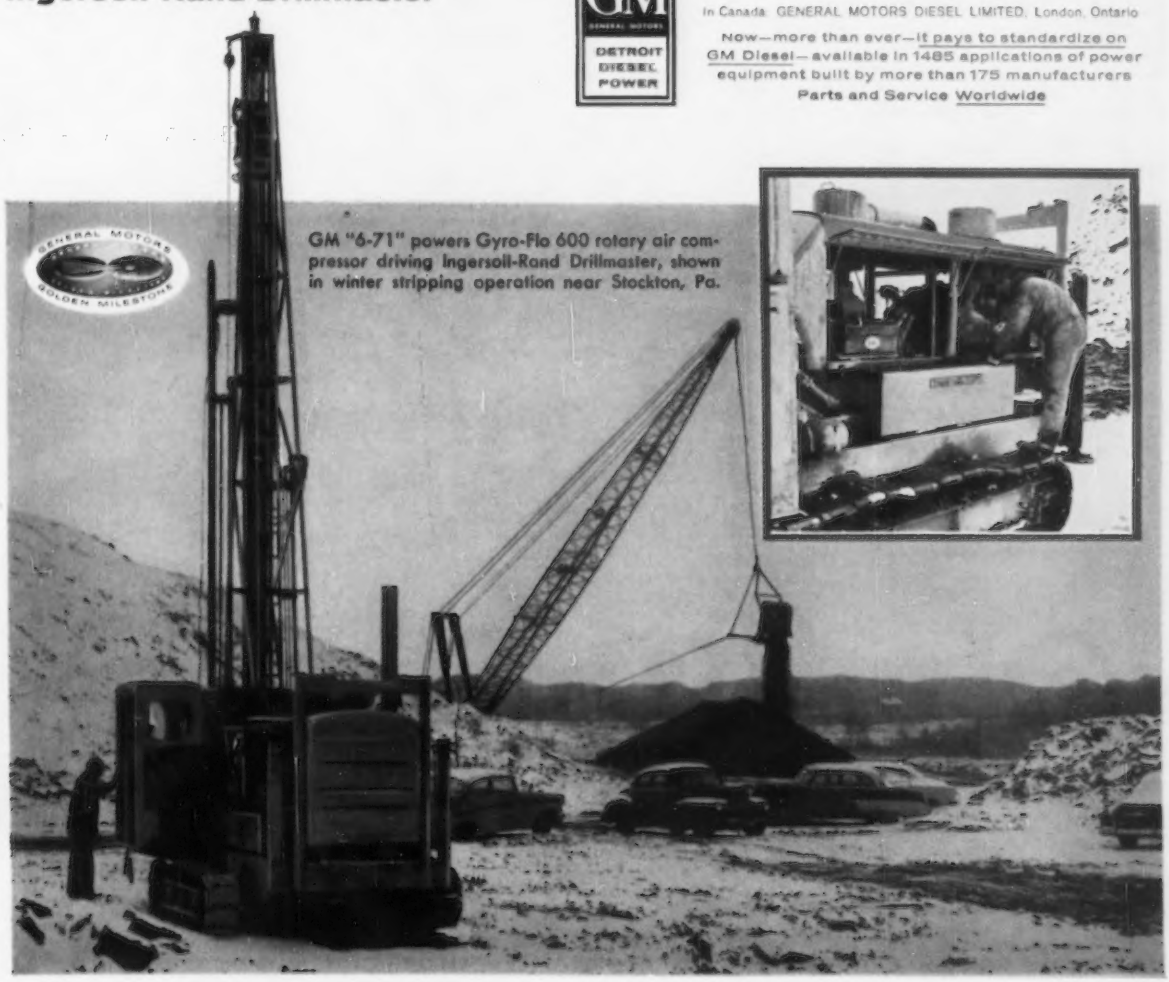

GM "6-71" powers Gyro-Flo 600 rotary air compressor driving Ingersoll-Rand Drillmaster, shown in winter stripping operation near Stockton, Pa.

In Iron Body Wedge Gate Valves,
Outside Screw and Yoke Design,

Walworth offers you these 8 outstanding advantages!

STRONGER CONNECTIONS. T-head disc-to-stem connection on OS&Y types permits wedge to properly seat itself.

TIGHTER SEAL. Solid web type disc on OS&Y valves provides tight closure, greater strength and longer service.

REDUCED TURBULENCE. Fluid action is minimized due to this straight-flow port design.

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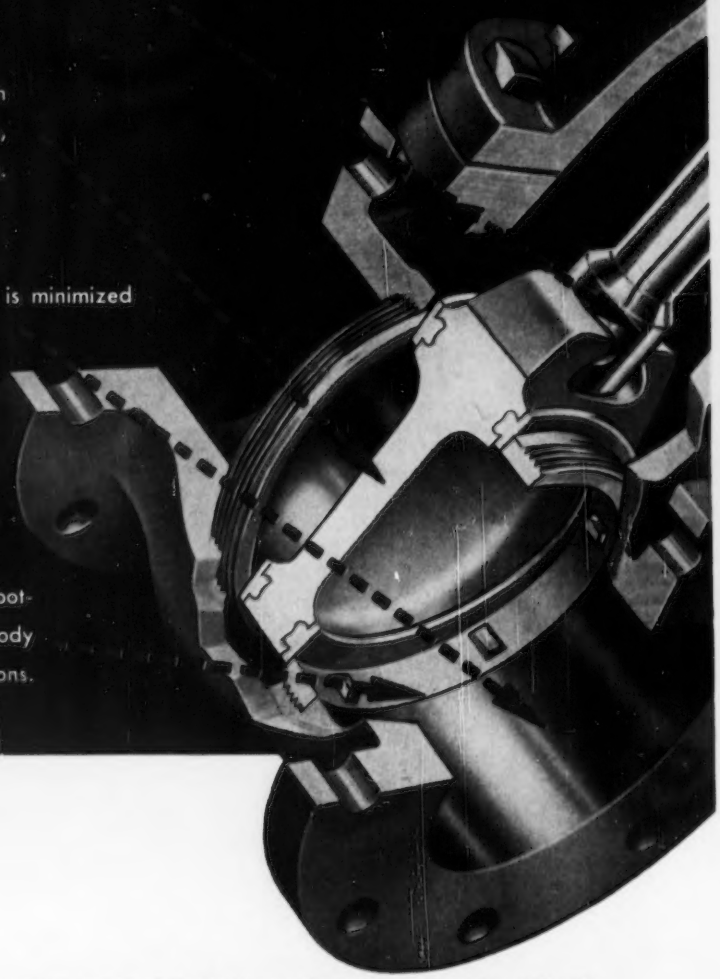

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SURE-GRIP HANDWHEEL. Fluted design assures a sure grip, even with greasy gloves.

HIGH CORROSION RESISTANCE. Brass liner protects glands from deterioration and scoring.

EASIER REPACKING. Hinged gland eye-bolts on OS&Y valves permit fast maintenance under full pressure.

LESS DAMAGE. Bronze back-seat bushing in bonnet of OS&Y valves prevents scoring, guides stem accurately.

Walworth Iron Body Gate Valves are available with screwed or flanged ends, in sizes and types for every purpose. For full information see your Walworth Distributor or write: *Walworth Company, 60 East 42nd Street, New York 17, N. Y.*

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Minnesota (*Continued*)

tons in 1958 working 15 shifts per week. Crude ore for the plant is provided by a dredge in the tailings pond.

31st annual meeting of the A.I.M.E.'s Minnesota Section was held in Duluth Jan. 13. Papers presented included: "Eagle Mountain Operation", by M.J. Hughes, mine manager at Eagle Mountain; "Engineering Education", by Dr. J.R. Van Pelt, president of Michigan College of Mining & Technology at Houghton; "Direct Reduction Processes", by D.C. Brown, assistant director of research, Jones & Laughlin Steel Corp.; "Human Relations", by Peter Apostolakos, training director, DM&IR Ry., Duluth; and "Iron Ore Deposits of Labrador and Quebec", by A.E. Moss, chief engineer; Iron Ore Co. of Canada.

MONTANA

Montana's 1957 mineral production, according to preliminary figures published by U. S. Bureau of Mines, showed a $30-million (14%) drop from the record 1956 total, mainly as the result of metal-mining closures and cutbacks in Silver Bow County adjusting to depressed markets.

	1957	1956
Chromite conc. (gr wt)	**119,371**	118,780
Copper (short tons)	**90,896**	96,426
Gold (troy oz)	**27,910**	38,121
Lead (tons)	**13,328**	18,642
Phosphatic rock (long tons)	**574,000**	557,479
Sand & gravel (short tons)	**9,500,000**	10,024,370
Silver (troy oz)	**5,114,050**	7,385,908
Stone (short tons)	**1,300,000**	1,274,385

Aluminum production at Anaconda's Columbia Falls plant was below the capacity rate of 60,000 tpy.

Talc, mined in Beaverhead and Madison Counties by Tri-State Minerals Co. and Sierra Talc & Clay Co., was expected to exceed production recorded for 1956.

Production at the Anaconda Aluminum Co. plant at Columbia Falls is scheduled to increase from 75 to 87½% of capacity after Jan 1. Current goes on Jan. 1 in half of the 60 pots that were taken out of production last June and July

Plant manager H. G. Satterthwaite said the increase will mean return of about 40 men to their jobs. Before, total employment at the plant was 578.

Zonolite Co., said this week that its vermiculite open pit mine near Libby is now yielding 3,000 tons of mill feed and about 500 tons of concentrates daily. Orville Thorn, mine superintendent, said that the payroll at the mine is now averaging about 120 men.

Minerals Engineering Co., Grand Junction, Colo, has announced plans for construction of an $8-million concentrator at its giant iron ore deposit on Carter Creek near Dillon.

North American Utilities Corp., Montreal, will build the mill, and Minerals Engineering will operate it.

The Canadian firm will provide working capital and pay for the mill. The two companies will split profits.

North American Utilities will use output of the concentrator at a steel mill it will construct in Canada.

Concentrator to be built at the Montana property will handle 3,000 tpd ore, turning out pellets at the rate of 1,000 tpd.

Jardine Mining Co., Park County, has filed a petition of voluntary bankruptcy in U.S. District Court in Butte, David Holland, deputy court clerk, reports. Petition states that the company has been active in mining and milling for 21 years but has not been in operation since 1948. The company claims assets of $1,020,264 with debts of $1,057,014, plus attorney fees and costs of $425.

Spokane office of the DMEA has contracted with Uranium Corporation of America to explore a copper property at Dailey copper mine in Jefferson County. Government participation in the $85,172 contract will be 50%.

NEVADA

1957 mineral production in this state was the lowest since 1953. It dropped

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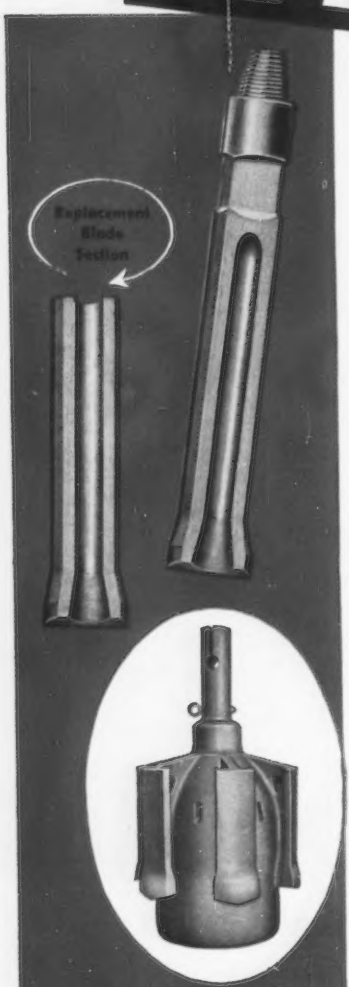
BLAST HOLE BITS

Drill More Holes Per Bit, At Less Cost Per Hole



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Available also, as an added economy, are SPANG REPLACEMENT BLADE SECTIONS in the same grades of steel, and uniform forge section, for welding to pin and collar sections of original bits when long service has worn the integral blade to a point where replacement is desirable.

Anyway you look at it, SPANG BITS are your best buy for more holes at less cost per hole.

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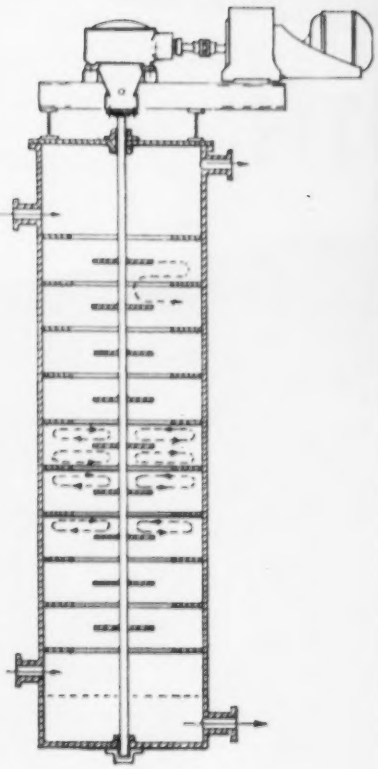

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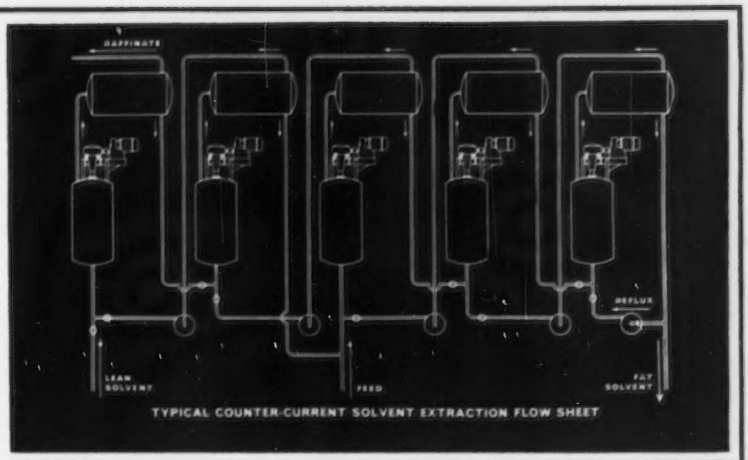

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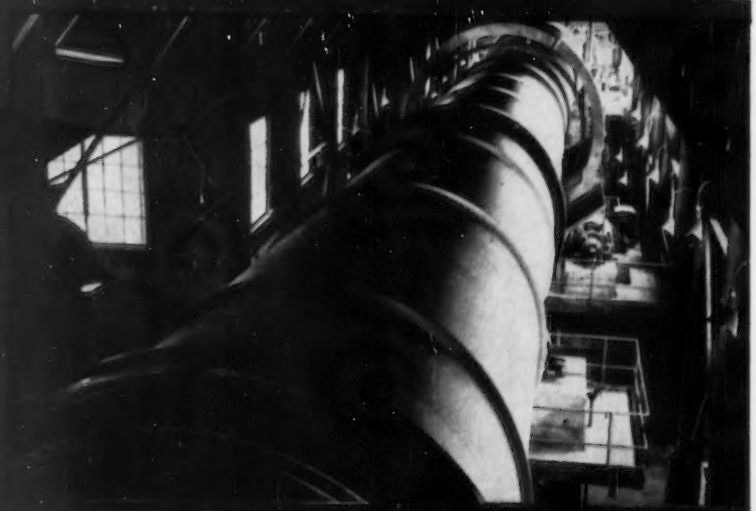

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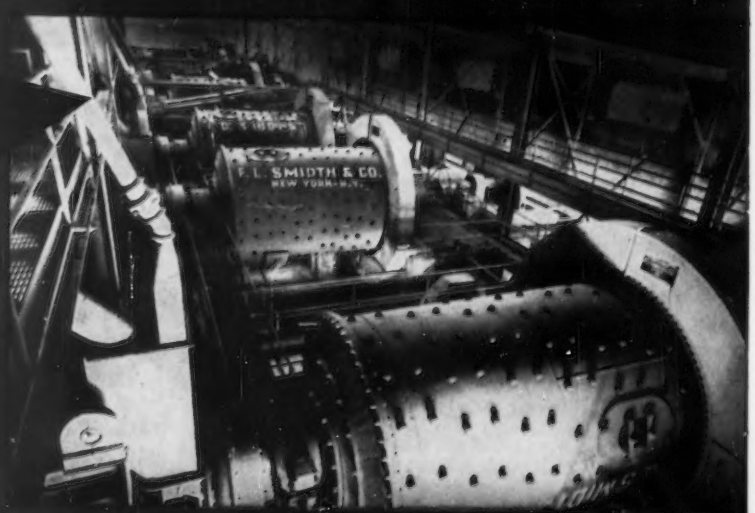

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Nevada *(Continued)*

sharply to an estimated $83,411,000 from the all-time high of $126,235,000 in 1956. Slump was due largely to cutbacks in mining of tungsten, copper, lead and zinc. Among the metals and metallic ores produced in Nevada, only gold and manganese showed advances in output compared with 1956—U.S. Bureau of Mines preliminary data.

	1957	1956
Barite (crude) (short tons)	**97,600**	178,400
Clays (short tons)	**11,000**	13,960
Copper (short tons)	**77,700**	82,883
Gold (fine oz)	**75,400**	72,646
Gypsum (short tons)	**733,000**	790,356
Iron ore (usable) (long tons)	**751,000**	916,592
Lead (short tons)	**5,800**	6,384
Manganese ore (35% or more Mn) (short tons)	**129,000**	121,482
Mercury (76 lb flasks)	**5,380**	5,859
Pumice, pumicite and volcanic cinder (short tons)	**13,000**	11,534
Sand & gravel (short tons)	**5,300,000**	4,686,513
Silver (fine oz)	**952,700**	1,220,473
Stone (short tons)	**1,500,000**	1,401,169
Talc & soapstone (short tons)	**10,300**	10,540
Tungsten conc. (60% WO_3)	**1,400**	5,400
Zinc (short tons)	**5,000**	7,488

Titanium Metals' plant at Henderson will continue to operate on its present schedule for at least the next six months, according to Phillip Maddex, general manager. Maddex, in refuting rumors of an impending shutdown, said the company will furnish employment for 800 workmen and technicians during the period, and denied that any of its power allotment from Hoover Dam will be surrendered. (See this month's review of Titanium, p 125.)

U. S. Mining and Milling Corp. has announced plans to reactivate the Bruhi mill at Silver Peak and to resume operations in the Nivloc mine nearby. Samuel L. Levine, company president, said work will start early in 1958, to develop what is reported to be a large untouched body of silver and gold ore beneath the 700-ft level of the mine.

Cliff Worthington, Delbert Pruitt and Jack Stowers, of Carlin, have started shipping iron ore mined in Dixie Valley from Southern Pacific's loading point at Colado, six miles east of Lovelock. The ore, reported to be as high as 68%, is being trucked on a recently completed road over Table Mountain through Anderson's Camp.

Pruitt and Stowers also have a low grade ore body leased from Minerals Materials Co. near the main property of that company in Coal Canyon. Previously unmarketable, it is now being mined and classified at Minerals' new magnetic separation plant.

HUBER-WARCO
motor graders

5D-190 in service on haul roads

When it comes to building and maintenance of haul roads, the Huber-Warco 5D-190 MOTOR GRADER is a natural. This rugged, powerful (195 h.p.) will open new roads, or smooth out existing haul roads to keep profitable payloads traveling. Big, yet easily maneuvered, the Huber-Warco 5D-190 features a diesel engine, torque converter, tail-shaft governor and power-shift transmission. Once the operator sets the speed the tail-shaft governor maintains it, regardless of load conditions. Operators favor this unit . . . NO CLUTCH . . . hydraulic controls . . . booster steering . . . it's easy to handle. There are many other outstanding features that make all Huber-Warco motor graders the most profitable on the job. See your Huber-Warco distributor for details on the complete motor grader line ranging from 75 to 195 h.p.

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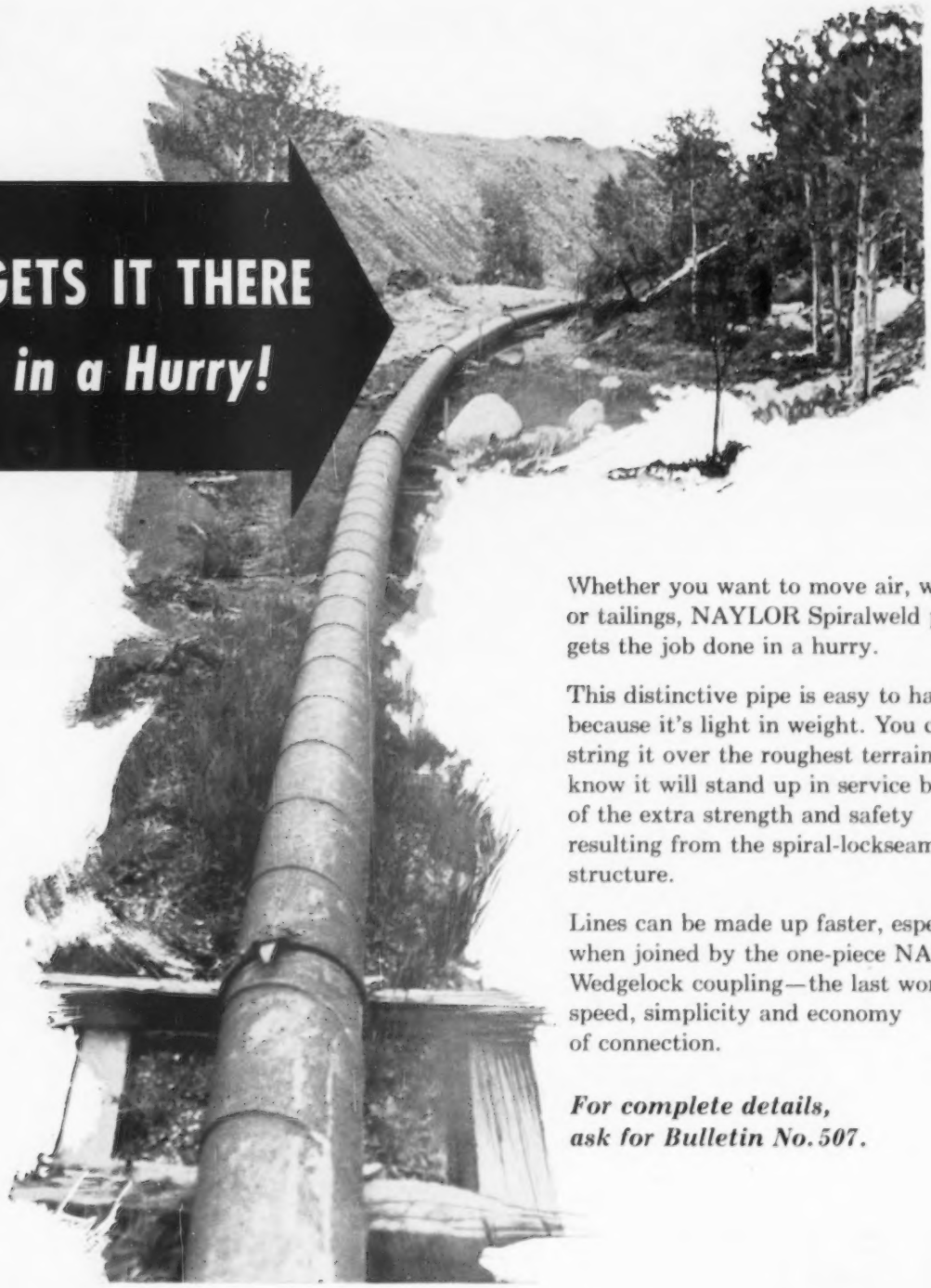

Whether you want to move air, water, or tailings, NAYLOR Spiralweld pipe gets the job done in a hurry.

This distinctive pipe is easy to handle because it's light in weight. You can string it over the roughest terrain and know it will stand up in service because of the extra strength and safety resulting from the spiral-lockseam structure.

Lines can be made up faster, especially when joined by the one-piece NAYLOR Wedgelock coupling—the last word in speed, simplicity and economy of connection.

For complete details, ask for Bulletin No. 507.

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Nevada *(Continued)*

Consolidated Coppermines Corp. and Kennecott Copper Corp. are discussing sale or other transfer of "Con Copper's" White Pine County properties to KCC's Nevada Mines Division. The multi-million dollar transaction would have great effect in the district and would end the two companies' 40 year rivalry.

Deepening problems brought about by the lowering price of copper during the last two years caused the revival of talks between the two firms at this time. Chester D. Tripp, Con Copper president, termed this a matter of "mutual problems." Con Copper ships ore to KCC mill at McGill. Without the Coppermines ore supply, mill and smelter would be seriously affected. During the present price squeeze, if Coppermines were to suspend operations, Nevada Consolidated (division) would probably also have to close.

NEW MEXICO

New Mexico metal mineral production was hard hit in 1957. In its report, the U.S. Bureau of Mines added that if petroleum, natural gas, and gas liquids had not shown a $60.6-million increase, State's total mineral value would have fallen below the 1956 level. Last year's mineral production total (excluding uranium) was $525.6-million; a gain of 8% over 1956.

	1957 (prelim.)	1956
Barite (short tons)	**3,000**	4,059
Beryllium conc. (gross wt.)	**30**	31
Clays (short tons)	**37,000**	39,623
Copper (short tons)	**65,500**	74,345
Gold (troy oz)	**3,600**	3,275
Lead (short tons)	**5,350**	6,042
Lime (short tons)	**22,000**	30,771
Manganese ore and conc. (35% or more Mn) (gross wt.)	**24,400**	22,012
Manganiferous ore and conc. (5.35% Mn) (gross wt.)	**42,500**	38,782
Perlite (crude) (short tons)	**175,000**	167,705
Potassium salts (K_2O equiv.) (short tons)	**2,028,000**	1,930,754
Sand & gravel (short tons)	**7,000,000**	6,054,500
Silver (troy oz)	**311,400**	392,967
Zinc (short tons)	**30,900**	35,010

Two utilities and a major construction company are investigating development of a large power plant in the Four Corners area.

Arizona Public Service, Public Service Co. of New Mexico and the Utah Construction Co., are jointly studying the development which would service the joining regions of Arizona, New Mexico, Utah and Colorado.

Utah Construction Co. recently acquired large strip coal reserves in the area, near Fruitland. The coal would be used for an adjacent steam electric generating plant.

HUBER-WARCO
motor graders

designed for rugged haul road work

Balanced weight and power to meet every grading requirement . . . that's the Huber-Warco 5D-190 MOTOR GRADER. A 195 h.p. diesel engine in combination with a torque converter, tail-shaft governor and power-shift transmission gives more power at the blade for faster passes and smoother cuts. Operators like the 5D-190 . . . there is NO CLUTCH . . . they just set the desired speed and the tail-shaft governor maintains the speed regardless of load conditions. The complete hydraulic cab-controlled blade movement is another important feature. In less than a minute, and without ever leaving the cab, the operator can move the blade from a 90° bank sloping position on one side to 90° on the other. There are NO manual adjustments to be made. These bonus features add up to MORE grader production. See your Huber-Warco distributor for complete details on the torque converter and standard transmission graders ranging in horsepower from 75 to 195 h.p.

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☐ 5D-190 ☐ other grader models
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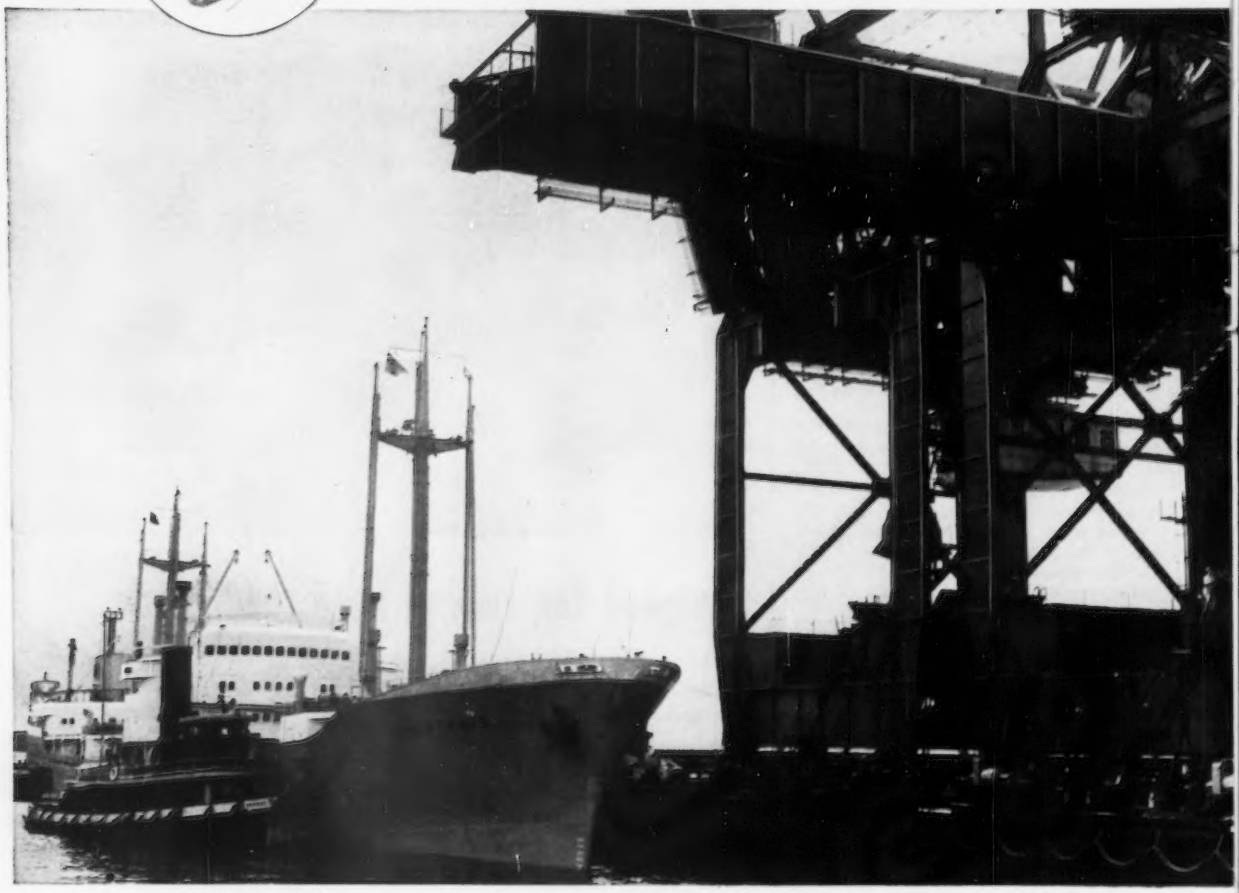
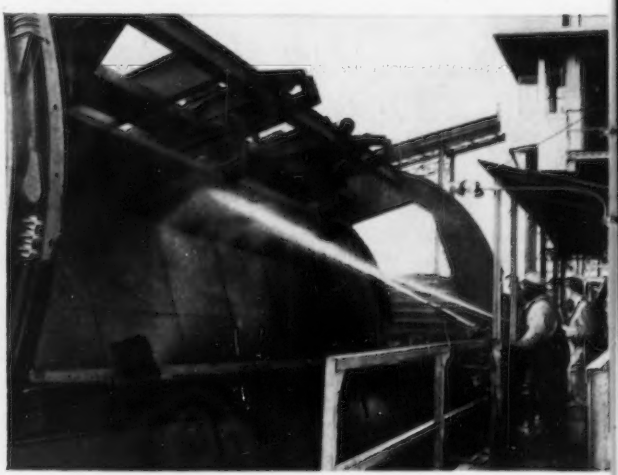
HUBER WARCO

Bulk cargo



C&O's new bulk cargo unloading facility at Newport News, Va., most modern on the Atlantic Coast.

Buckets to handle various types of ore or vessel range from 18 tons to 6 tons capacity. Buckets can be changed in less than five minutes.



Each open top car is thoroughly flushed out before loading with ore.

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Twin conveyors and car loading hoppers handle two types of ore at the same time without sacrifice of loading speed.

Electronic weighing, accurate to the pound, eliminates track scales.

Chesapeake and Ohio's newly completed bulk cargo unloading facility at Newport News, Va., is handling a fast-growing flow of import ores and other bulk cargoes with record-breaking speed and efficiency. Using the best features of American and European designs, the facility's three unloaders are the "slewing jib" type in which 190-ton gondolas, carrying an operator, controls and hoisting machinery, move on trolleys to pick up and discharge in 45-second cycles their 18-ton loads. Turning in full circle, they clean out every corner of a ship's hold without auxiliary equipment aboard ship. Moving on rails along the finger type pier, designed to accommodate the largest ore carriers afloat, the unloaders simultaneously work ships on either side of the pier.

Coupled with C&O's ready car supply and swift rail movement inland, this $8½ million installation offers ore importers a new standard of transportation service. For ships, it means faster turn-around at Chesapeake and Ohio's "Quick Access" port of Newport News on Hampton Roads.

Write for illustrated folder showing in detail the operation and advantages of C&O's new bulk cargo unloading facility.

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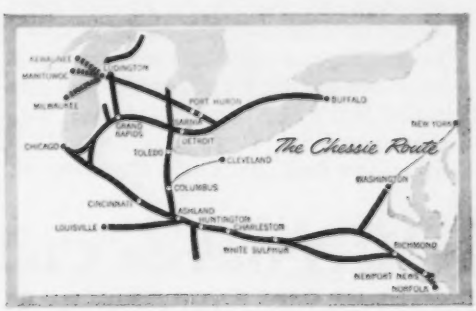

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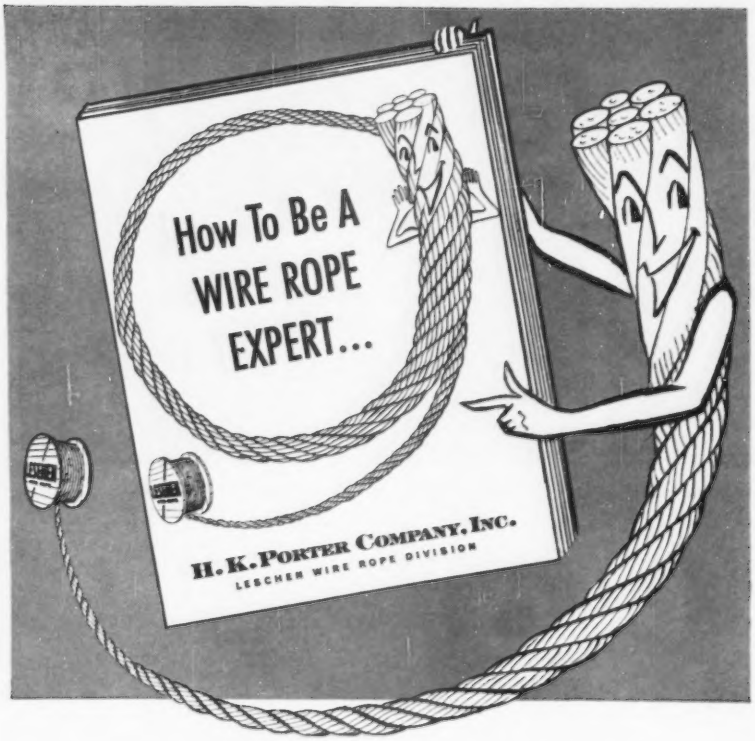

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Knowing how to select the best wire rope for the job not only helps reduce costs, but it may also help you to get that job done more efficiently. You'll find the facts you need to know in the book shown above. It has been specifically edited and illustrated for easy understanding by non-technical readers. It describes the forces that tend to destroy wire rope and then, step by step, shows how to determine which wire rope construction will provide the greatest possible resistance to the destructive forces you have found most troublesome. It's an interesting and helpful aid that every wire rope user ought to have. Send for free copy today. Write H. K. Porter Company, Inc., Leschen Wire Rope Division, 2727 Hamilton Ave., St. Louis 12, Missouri.

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New Mexico *(Continued)*

Low cost power generated by such a plant would become available to the local area now experiencing an industrial development in mining, oil and gas. A substantial part of the power would become available for export over new transmission lines to the interconnected utility systems in Arizona and New Mexico.

NORTH CAROLINA

Piedmont Properties Inc., Alcoa affiliate, which for the past three years has beea prospecting for alumina ores along the North Carolina-South Carolina border, announced Jan. 8 it would discontinue prospecting in the area and that it would close its laboratory at Spartanburg, S.C., within a few weeks. Announcement was made by Maurice Bennet, company manager, who said Alcoa has no plans for exploring ore in adjoining counties. Options obtained by the company covered about 31,000 acres in several counties in the two states and drilling was carried out on 16,000 acres. **North Carolina Council of State on Jan. 7 returned a proposed lease to the N. C. Board of Conservation and Development** for further consideration; a lease which would give the Bear Creek Mining Co. phosphate mining rights on some 60,000 acres of state-owned lands in Hyde and Beaufort Counties.

It was suggested that the board "renegotiate" with Bear Creek and other firms interested in the lease.

D. T. Bailey, president of the Bryan Rock & Sand Co. of Rocky Mount, which is affiliated with the General Crude Oil Co. of Houston, Tex., in a letter to Governor Luther H. Hodges, said approval of the Bear Creek lease would amount to handing the firm a monopoly. General has also shown an interest in phosphate drilling rights in the involved area, but was not represented at a hearing before the C&D Board's Minerals Resources Committee last summer when the board approved Bear Creek's lease.

Under terms of the proposed lease, Bear Creek would have paid the state $15,000 a year during an exploration period, which would not exceed five years. If at any time during the five years the company thought mining would be profitable, it could convert the exploration lease into a mining lease and pay royalty to the state based on the market price of phosphate at the time.

NORTH DAKOTA

Mineral production in 1957, due to the increase in mineral-fuel value, totaled $57.4-million (7% gain over the 1956 figure).

	1957	1956
Stone (short tons)	**85,000**	82,999
Sulphur (long tons)	**10,600**	1,735

OREGON

Mineral output in the state again increased in 1957, according to preliminary data; total value of all minerals produced rose from $34.0-million to $37.6-million (11%). Mercury, cement, sand and gravel, stone, and particularly nickel receded to a more normal level owing to the completion of work on Government stockpiled material.

	1957	1956
Chromite (short tons)	**7,800**	54,577
Clays (short tons)	**235,000**	256,942
Mercury (76 lb flasks)	**3,870**	1,893
Nickel ore (nickel content)	**15,000**	6,866
Sand & gravel (short tons)	**12,000,000**	11,637,183
Stone (short tons)	**6,500,000**	6,097,965

Silver output was greater than in 1956 and most of the metal was taken from Boaz Mining Co.'s Buffalo mine.

Uranium's big news was the AEC approval for construction of a $2.6-million ore-processing mill near Lakeview.

UTAH

Utah's 1957 mineral production, like that of other western mining states, suffered a sharp drop from the 1956 level. U. S. Bureau of Mines preliminary annual figures for the state include:

	1957	1956
Copper (short tons)	**233,800**	250,604
Fluorspar (short tons)	**13,000**	10,581
Gold (troy oz)	**376,900**	416,031
Iron ore (usable) (long tons)	**4,151,000**	4,001,739
Lead (short tons)	**44,200**	49,555
Lime (short tons)	**52,000**	55,110
Perlite (crude)	**3,000**	2,271
Phosphate rock (long tons)	**100,000**	124,773
Pumice (short tons)	**3,000**	44,769
Salt (short tons)	**200,000**	183,701
Sand & gravel (short tons)	**6,000,000**	5,835,500
Silver (troy oz)	**6,190,400**	6,572,041
Stone (short tons)	**2,200,000**	2,321,636
Vanadium (lb)	**1,017,000**	1,098,802
Zinc (short tons)	**40,200**	42,374

Uranium Reduction Co.'s operating concentrator at Moab, reports net earnings of $594,600, equal to 30c a share for fiscal period ended June 30, 1957.

It was the first annual report of the company, headed by Mitchell Melich, Moab.

In the report, Melich said that URC is currently in negotiation with the AEC to extend its sales contract for concentrates past March 31, 1962 in conformance with the 1962-1966 AEC buying program.

He said that during the last fiscal period, URC spent $2.65-million in completion of mill and for "certain refinement" of facilities. "The mill was originally estimated to cost $8.25-million but

Quaker conveyor belting installation used in ore mining.

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Quaker conveyor belting has high abrasive resistance

Quaker conveyor belting is especially designed for carrying highly abrasive materials such as mine ores, trap rock, shales, and machined metal parts. The heavy-duty cover resists sharp abrasion and extra wear caused by material caught between boot pulley and belt. Quaker belting is resilient—engineered to withstand the high flexing of short centers and the tension of long hauls. It is constructed with extra-tough covers and carcass to resist severe impact.

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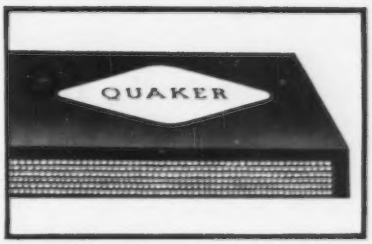

Cross-section Quaker No. 1 grade conveyor belt; 6-ply N-50 heavy cotton-nylon fabric, skim-coated between plies.

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on Quaker belting, containing information on performance, specifications, and sizes, write to QUAKER RUBBER DIVISION, H. K. PORTER COMPANY, INC.: Phila. 24, Pa., or Pittsburg, California.

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Utah *(Continued)*

actual completed cost was $8.54-million, an over-run of $290,000 or 3.5% Melich said. Report discloses the mill has efficiently run 1,750 tpd uranium ore although rated capacity is 1,500 tpd.

International Smelting & Refining Co. was to close its lead blast furnace at Tooele, Utah, reduction center in late January, laying off between 50 and 60 men. Plant manager W. J. McKenna of the Anaconda Co. subsidiary said closure resulted from depleted supply of ores, which has reduced concentrate input to the lead blast furnace.

Ore drop-off results from closure of independent lead-silver-zinc mines in Utah, California and other western states which shipped to the IS&R plant.

McKenna said the concentrators at Tooele would continue to process ores until the concentrates stockpile was rebuilt. The lead blast furnace closure probably will last for a number of months.

WASHINGTON

Washington mineral production value dropped from $61.6-million in 1956 to $57.2-million in 1957, according to preliminary reports from the U.S. Bureau of Mines. Copper and zinc values were down $1.5-million and $1.7-million, respectively, as result of mine closures; cement production was 15% below the 1956 level because of strikes; and lead values remained at the same level as in 1956 despite an increase to a new record total in tonnage mined.

	1957	1956
Copper (short tons)	**1,660**	2,926
Iron ore (hematite) (long tons)	**1,934**	2,201
Lead (short tons)	**12,342**	11,657
Sand & gravel (short tons)	**17,000,000**	16,841,792
Stone (short tons)	**9,000,000**	8,057,338
Zinc (short tons)	**23,139**	25,609
Clay (short tons)	**320,000**	319,988

Gold output was mainly supplied by the Knob Hill Mines, Inc., and the Lovitt Mining Co. Gold was recovered from lead-zinc ore produced at several properties. Uranium operations went into high gear at Dawn Mining Co.'s new $3-million processing plant at Ford.

Pend Oreille Mines and Metals Co., Spokane, said that it is reducing its operations in the Metaline district to a five-day week because of current low metal prices.

The Pend Oreille zinc-lead mine, which the company operates at Metaline Falls, is Washington's largest. Company officials said that the new schedule was to go into effect Jan. 1.

Daybreak Uranium Inc., Spokane, said it has received a $24,000 check for two 55-tons lots of uranium ore sent to Dawn Mining Co.'s processing mill at Ford.

Kae H. Sowers, Daybreak secretary-treasurer, said that up to to 250 tpd

Le Roi CRD one-use bits were used to drill shot- and roof-bolt holes for this tunnel. Upper opening shown, is 43½ ft. wide.

Only CRD Bits Meet Glen Canyon Test

"The CRD one-use bit was superior to any of the ten brands we tested," reports superintendent.

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Pre-job tests revealed that the Le Roi CRD one-use bits offered the best cost-output advantages for the grueling job ahead. That's why they were chosen to drill two spillway tunnels through solid sandstone for the Glen Canyon Dam in Utah.

Here's how they scored. "Drilling in this sandstone," the tunnel superintendent reports, "the CRD bits averaged 48 ft., compared to an average of only 32 ft. for the other nine competing brands."

"Some bits were a little more durable," he adds. "But they cost up to $12 each, compared to the 24 cents we pay for each CRD bit."

Carbide bits were also tried, but proved impractical. The sand encountered on the job was as abrasive as the grinders used to sharpen the bits, causing them to lose their gauge too quickly.

Help Keep Schedule

On the job, the Le Roi bits are living up to expectations. "We use them to drill shot holes under the roughest conditions I've ever seen," the superintendent states.

In addition to the highly abrasive stone, the bits have to cope with mud and bad water seepage. Yet the bits average 4 to 4½ minutes per 18 ft. hole. As a result, "the first of the two long tunnels is being dug at an average rate of 15 ft. per day."

Le Roi H10AL air legs are used with the CRD one-use bits and comprise 95% of the drilling equipment used on the job. "The Le Roi units are doing a good job for us in the tunnel, helping us to keep the project on schedule," the superintendent concludes.

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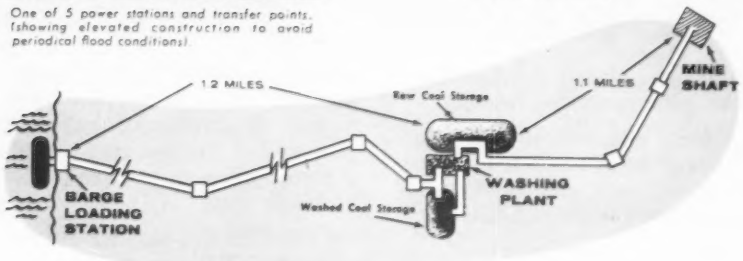

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Washington *(Continued)*

are being mined from and 2,000 tons are stockpiled at the Daybreak mine on Mount Spokane.

Utahcan, Inc., Spokane, is proceeding with construction of a mill at its lead-zinc-silver property in Pend Oreille County. Currently, there is about two feet of snow at the property, but Utahcan has about 10 men working at the property in the Jim Creek district at an elevation of 4500 ft. Work is nearing completion on the mill project.

WYOMING

Wyoming's 1957 mineral production value totaled $355.7-million (exclusive of uranium) compared with $314.8-million in 1956, according to preliminary figures put out by the U.S. Bureau of Mines. The $40.9-million increase was due almost entirely to the gain in the value of liquid-mineral fuels.

	1957	1956
Clay (short tons)	**780,000**	1,053,452
Copper (short tons)	**4**	3
Feldspar (long tons)	**300**	1,201
Gold (troy oz)	**440**	762
Phosphate rock (long tons)	**100,000**	119,230
Pumice (short tons)	**49,254**	45,517
Silver (troy oz)	**70**	154
Sulphur (long tons)	**130,000**	121,161

Rocky Mountain Standard Co. has announced plans to build a 300-tpd uranium upgrading plant on about 2,000 acres in Little Lightning Creek area south of Lance Creek, if uranium ore reserves prove to be sufficient.

Columbia-Geneva division of U.S. Steel Corp. has exercised its final options on a large group of mining claims near Atlantic City, where it may build an iron ore beneficiation plant.

Documents filed with the Fremont county clerk indicate about $44,500 was paid to a group of men who owned the lode and placer mining claims.

Claims involved were Rock Creek lode claims, Slate Creek Mining lode claims, Rozelle placer claims, Golden Nugget placer claim and the Gold Star and Red Jacket lode claims.

Phillips Petroleum Corp. has purchased 58 uranium claims in the Shirley Basin area. The claims were sold by Stewart Exploration Co. of Blackfoot, Idaho.

Homestake Mining Co. plans to start uranium shaft operations at Hauber Mine near Moorcroft next spring. Company has begun sinking a 400 ft shaft, which it expects to have completed by April. Uranium in surface rocks were first discovered on the property in 1953 and small scale production has been obtained from surface ore bodies.

Gov. Milward L. Simpson has directed the Wyoming Natural Resource Board

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Tires haul 25 tons of coal or rock, give strip miner 2 retreads!

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Because of this tire-killing work, the Reading people were plagued by blowouts from rock impacts. Mileage was disappointing, and often tires could not be retreaded. Then the company began using B.F.Goodrich FLEX-RITE NYLON Rock Service tires. Result: substantially more service than from other tires—as many as 2 retreads per tire with up to 80% of original service on each retread.

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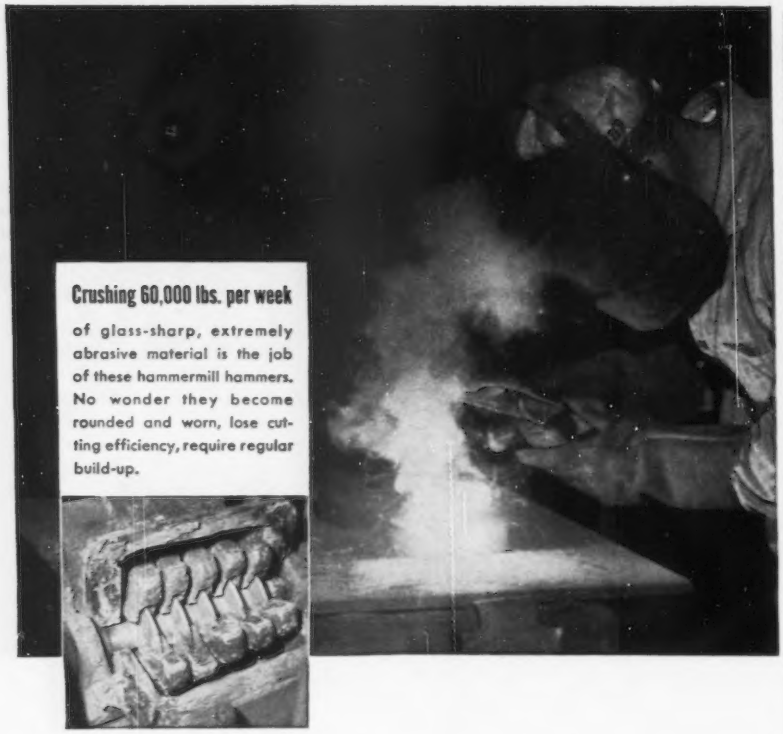

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Wyoming *(Continued)*

to initiate a complete study of the state's uranium resources in an effort to attract additional milling capacity.

Resource board officials and representatives of the Wyoming Mining Assn. met with the AEC in Washington on Jan. 15 to present the state's case.

Simpson said unless more processing mills are located in the Gas Hills area, the uranium industry will stagnate. He added that Wyoming now has an estimated 20-million tons of uranium ore reserves, but several other states with less reserves have more milling capacity.

A $411,000 payment was made Dec. 31 to banks which helped finance construction of Wyoming's first uranium mill, Robert W. Adams, president of Western Nuclear Corp. announced.

Adams said $351,000 was paid on the principal and $60,000 in interest to a group of Denver and eastern banks. Payment on the principal was $51,000 greater than required under the repayment schedule.

Western Nuclear operates a 400 tpd mill at Jeffrey City.

AEC's Casper work force will be increased from four to 20 men, Sen. O'Mahoney (D.-Wyo) announced.

The 20-man Casper office will handle ore evaulation and other duties in Wyoming, parts of Colorado and South Dakota. However, contracts will still be negotiated by the AEC's Grand Junction office.

"This increase in Casper shows the AEC recognized the value of central Wyoming uranium deposits," O'Mahoney added.

Four men now stationed in Riverton will remain there, but two AEC officials now at Rawlins will be transferred, O'Mahoney said.

Archer-Daniels-Midland Co. of Minneapolis, Minn. expects to complete construction in February on a new bentonite processing plant near Colony.

ADM reportedly has 25,000 acres of open pit bentonite mining property in the northeastern corner of state and will supply Minnesota's taconite industry.

Warner B. Bishop, vice president and manager of ADM's federal foundry supply division, said the Colony plant will be a push-button installation. The entire processing operation will be controlled from a central control room.

Processing plant will be a steel structure 300x50 ft with two concrete storage silos capable of holding 1,000 tons of pulverized bentonite. The bentonite will go through a huge dryer where moisture content will be reduced from 28- to 6- or 7%. After drying, the clay will be pulverized in roller mills.

IN CANADA

ONTARIO

Mill operations at Macassa Mines, Kirkland gold producer, have been boosted

Shown here is one of two Bucyrus-Erie 51-Bs working in an open-cut at a large copper mine in western U.S.

Fast-Working Shovels Help Make Open-Cut Mining Economical

In this open cut at a large Montana mine, two Bucyrus-Erie 51-Bs load out granite and copper ore economically every day.

Like other Bucyrus-Erie excavators, these 2-yd. 51-Bs get their traditionally fast cycle from a combination of features — including careful balance of speed and power with constant response from clutches and brakes that lets the operator smoothly coordinate every shovel movement.

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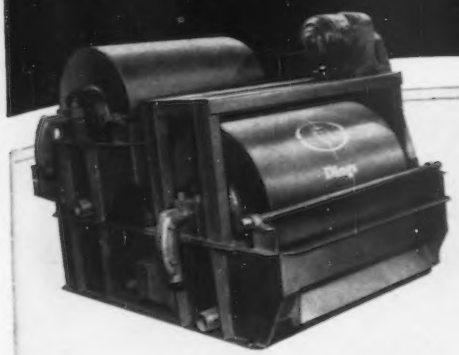
DINGS WET DRUM MAGNETIC SEPARATORS

to solve your concentration or recovery problems



■ Dings manufactures a complete line of both electric and Alnico (permanent, non-electric) Wet Magnetic Drum Type Separators to meet the specific requirements of the mining industry . . . ranging from high intensity units for cobbing taconite from rod or ball mill discharge, through all phases of media recovery, to triple stage taconite finisher duty. Whether your requirements call for individual drum units, or expert consultation service for complete concentration or recovery installations, Dings can help you achieve the greatest efficiency with the greatest economy.

Full Size Range for every requirement: Dings Wet Drum Separators are available in single drum or multiple stage construction, with drum diameters of 24", 30" and 36". Drum widths, starting with a 12" laboratory unit, increase in 6" increments up to 72" wide.

Choice of designs to meet specific needs

Concentration

Two basic types for Taconite and Magnetite concentration include: (1) Cobber Type Drums for rod and ball mill discharge, designed to permit greater pool area for discharge of high tonnages of non-magnetic tailings, and used with higher field intensities to obtain maximum rejection of non-magnetics. (2) Finisher Drums, which combine full width "curtain" washing action with narrow gap pole spacing and lower field intensities to assure uniform discharge of maximum grade concentrates.

Heavy Media Separation

Dings offers two basic types which may be used independently or in any combination of multiple stage design: (1) Super intensity electromagnetic drums (36" diam.) for maximum recoveries of media, obtaining optimum purity with minimum entrapment of non-magnetic material. (2) High intensity electro and permanent magnetic drums (30" diam.) for secondary duty or primary duty on less demanding applications. Concurrent design provides a large arc of contact to produce high density, clean concentrates with reduced losses.

Whatever your concentration or recovery problem, Dings can help you solve it. When you write for full information, ask for Bulletin B-1500.

WC158-3/3

Dings

DINGS MAGNETIC SEPARATOR COMPANY

4716 W. Electric Ave., Milwaukee 46, Wis.

Ontario *(Continued)*

from 400 to 500 tpd. Expansion was undertaken following the building up of ore reserves in 1956. In that year, reserves were upped from 437,830 tons grading 0.421 oz gold per ton to 833,167 tons grading 0.457 oz. During 1957, reserves were fairly well maintained—total of 1,907 ft of new ore averaging 0.47 oz gold per ton were opened in the first nine months.

Hallnor Mines has embarked on a program of deep diamond drilling at its gold producing mine in the Porcupine area. Program is expected to be completed early this year and a decision will then be made as to whether or not shaft sinking to deeper horizons is warranted. The company, which is now nearing its 20th production year, is controlled by Noranda Mines.

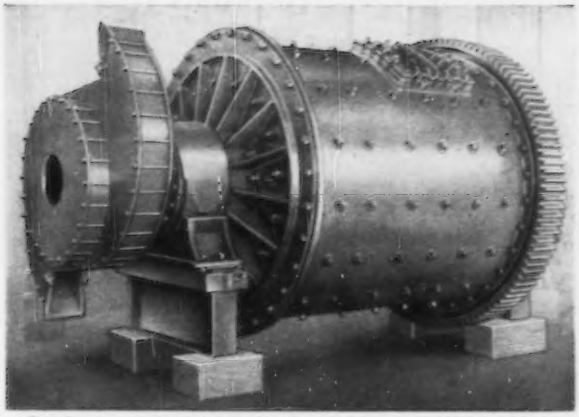
Rio Tinto Mining Co. of Canada and Dow Chemical of Canada have formed a new company, Rio Tinto-Dow Ltd., for the production of Canadian thorium products. The new firm will first concentrate on thorium and rare earths production from byproducts of the Eliot Lake area's uranium mines. Thorium content of uranium ores of Algom, Northspan and Milliken Lake is presently being wasted.

Temagami Mining Co. is stockpiling development ore from its copper property at Lake Temagami for sale at a later date. In the final quarter of 1957, an additional 2,861 tons averaging 11% copper and 36 tons averaging 25% copper were stockpiled. New ore estimates for various zones have been made and are: For the No. 5 orebody, 3,000 tons grading 20% copper; for the No. 4 zone, 14,000 tons grading 15% copper with the zone still open both to the east and west. Favorable results are also being obtained in underground work in other zones.

Rio Canadian Exploration, the exploration arm of Rio Tinto Mining Co. of Canada, has obtained promising initial results in diamond drilling on a molybdenite prospect in Echo Twp, Sioux Lookout area. A new company, Pidgeon Molybdenum Mines, was formed to take over the property. Wide sections of mineralization were encountered in initial drilling and work continues.

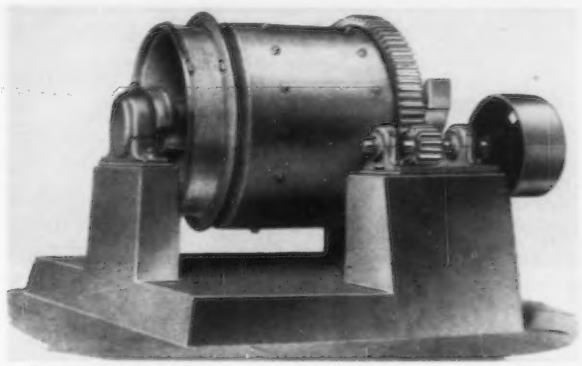
Aunor Gold Mines has increased mill rate from 500 to 600 tpd at its Porcupine area gold mine. This is the first step in a mill expansion program which calls for milling of 750 tpd. It's anticipated that the objective will be reached by early summer. Capacity of fine ore bins and hoisting facilities are being enlarged. Development on lower levels was intensified during the past year and stoping is being started. This new area will provide additions to ore reserves, which at the beginning of 1957 were estimated at 782,000 tons averaging 0.374 oz gold per ton.

Silver-Miller Mines has suspended milling operations with the view of assuring continuous capacity feeding and more

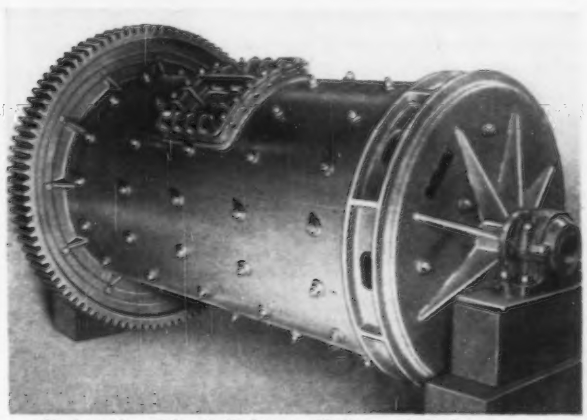


Overflow or grate discharge type flanged to permit extending length.

Double end, center peripheral discharge type for most granular product with minimum amount of fines.



Screening mill delivers a sized product. Unequalled for producing granular product within the limits of screening.



Single end peripheral discharge mill for rapid discharge granular product.

STRAUB MILLS

with advanced features at no extra cost!

ALL STEEL CONSTRUCTION — For over thirty years, Straub has pioneered all steel design for maximum strength and freedom from breakage. Less weight reduces shipping charges and H.P. requirements.

MANGANESE LINERS permit thinner sections when new for increased mill volume and capacity. Manganese can be worn thinner for longer life and less scrap loss. Spiral rib liners standard. Any other design available.

LARGER, SELF-ALIGNING BEARINGS assure low bearing pressures for long life. Self-aligning takes care of minor inaccuracies in foundation and any shell deflection during operation. Pinion bearings unitized ring oiling type or antifriction self-aligning type.

REVERSIBLE MAIN GEARS permit wearing both sides of teeth. Furnished steel cut tooth, semi steel cut tooth or cast tooth depending on size and type of mill. Pinion gears are cut tooth, heat treated steel.

BALL OR ROD MILLS AVAILABLE — Plain overflow, grate discharge, single end peripheral discharge, double end center peripheral discharge, screening mills, extensible mills — standard or sectionalized construction for difficult transportation. Capacities from 2 tons per day and up.

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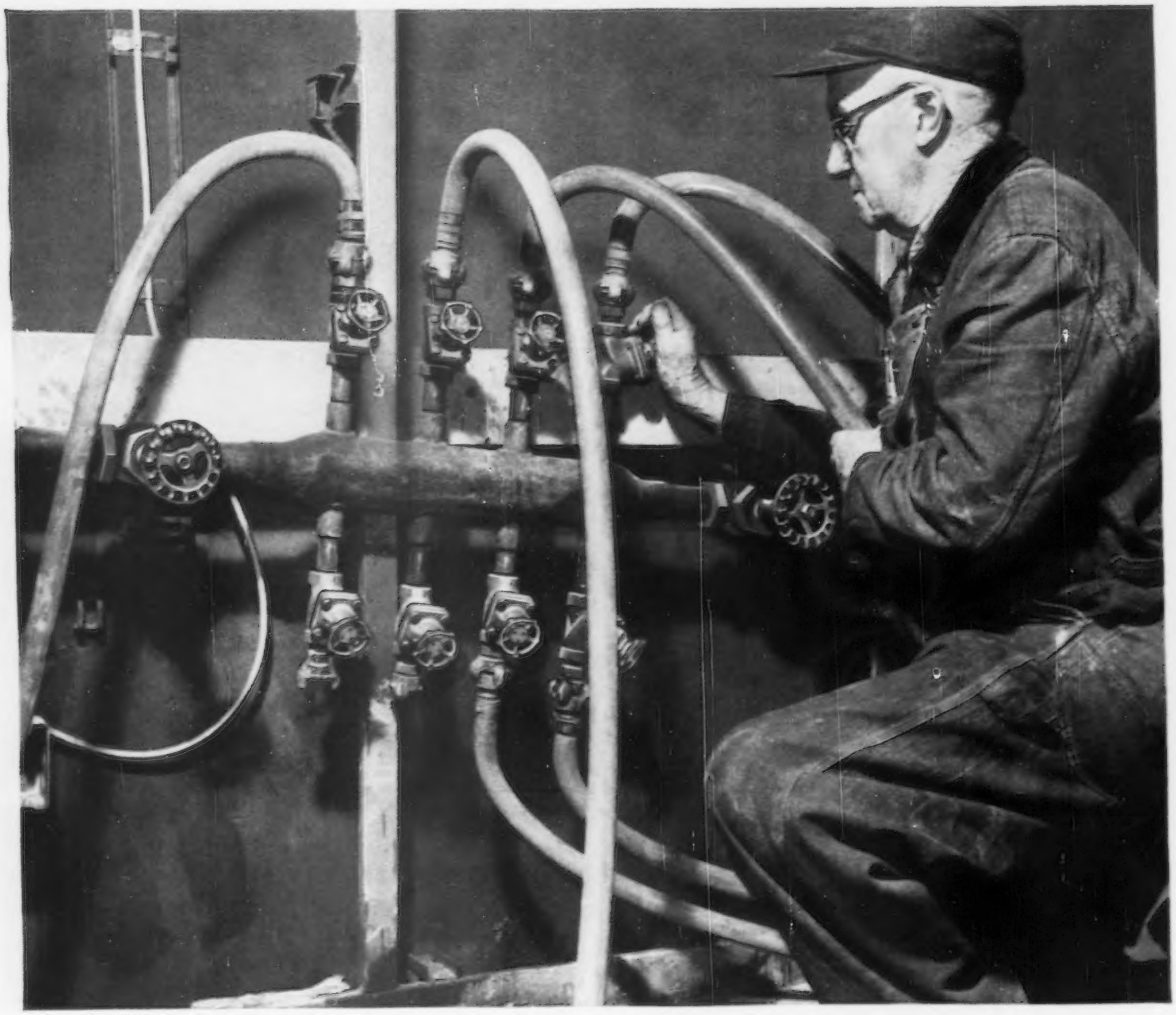
Crane helps another valve user stop high replacement costs



How they solved valve failure on air service

This case history from Willamette Iron & Steel Co., Portland, Ore., shows how you can cut compressed air handling costs in your own plant.

These Crane packless diaphragm valves are handling 100 psi. air on manifolds to distribution lines used aboard ship during construction. Before installing the Crane ¾-inch No. 1610 valves, the yard was troubled by constantly rising maintenance costs. With the other make valves, diaphragms were rupturing after a short time, requiring continual replacement. Loss of air and air power for equipment was costly.

Crane packless diaphragm valves were installed because their neoprene diaphragm functions only as a bonnet seal, and is not subjected to crushing and wear when used as a seating member. The maintenance problem was effectively solved, as it is for so many users throughout industry, by installing the right Crane valve. Contact your Crane Representative today—ask him for complete information on any application.

ASK FOR Crane Folder AD-1942 on packless diaphragm valves. Contact your Crane Representative for a copy, or write to Crane Co., at address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

Dumping uranium ore at reduction mill in Moab, Utah. The bluff in the background indicates the terrain encountered by G. P. Decker's Macks, which are . . .

hauling today's most crucial cargo —uranium

Tortuous terrain, crisscrossed by deep canyons, arroyos and stretches of drifting sand, characterizes the "Four Corners" area of Utah, Colorado, New Mexico and Arizona, where a large amount of America's uranium is mined.

Truck operations here are hazardous and expensive. Despite these conditions, the uranium ore must be moved from the remote mines to the reduction mill in Moab, Utah. G. P. Decker is one of the more successful uranium haulage contractors in this area who depends on Macks.

Mr. Decker started out with 4 Mack diesels. He now operates 16. He has found that Mack's powerful diesel engine, coupled with the Mack 20-speed Quadruplex transmission, makes short work of the steep grades and winding roads encountered in this area. Mack's exclusive Balanced Bogie with Power Divider, which applies power to the wheels with the most traction, gives safe, sure pulling power, even through the windswept sand that drifts across the roads.

Mack's low-cost upkeep, minimum down time, and large capacity payloads mean a more profitable operation for Mr. Decker. They will for you, too. Your nearest Mack representative will be glad to give you the names of Mack users near you. You will find them as pleased with their Macks as Mr. Decker is with his. Mack Trucks, Inc., Plainfield, N. J. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

5777

In the largest underground mine in the United States, over 70% of the daily production of 28,000 tons of molybdenum ores — more than half of all the moly this side of the iron curtain — is hauled in Card Granby type cars built to Climax specifications.

These are the largest and heaviest cars of this type we have built . . . designed to withstand unusually rugged loading conditions plus the wear and tear inflicted by a cleanout machine (also a Card product).

CARD car engineering results in large savings to many of the major ore producers of the world with cars built to special order at little more than the cost of standard stock models. CARD engineers are happy to consult on any haulage problem. No obligation.

C.S. Card Iron Works Co.
2501 WEST 16th AVE.,
DENVER, COLORADO

Ontario *(Continued)*

economical operation of the 300 tpd LaRose mill at its Cobalt area property. With termination of government contracts for cobalt and decline in copper price, the company is now mining silver ores. Underground development will be stepped up to break enough ore to permit resumption of milling at capacity rate in summer of 1958.

Promising results are being obtained in metallurgical testing on material from the iron property of El Sol Mining in the Papaonga Lake Area. Assays on 11 cores, taken from holes drilled early in 1957 on the company's two main zones, returned an average of 34% iron. Concentrates made from composite samples obtained from drill cores had a total iron content of 70.8%, while silica ran 2%.

Upper Canada Mines is planning to deepen the No. 1 shaft at its gold producing mine in Kirkland Lake area. Shaft will be dropped from its present depth of 3747 ft to 4375 ft to open five additional levels at 150-ft intervals. Several factors prompted the decision to undertake the program. Lateral work on the present lower levels has shown improvement in values with additional depth. Limited diamond drilling below the bottom, or 3625 level, has indicated downward extension of structure for about 400 ft. To help relieve pressure on hoisting facilities in the No. 1 shaft while sinking is in progress, ore may be drawn from relatively shallow depths in the No. 2 shaft area.

QUEBEC

Copper Rand Chibougamau Mines is continuing operations at its Chibougamau property with eyes set on a spring 1959 production starting time. Although final decision on mill size has not been reached, it's understood that present thinking is along lines of a 1,500-2,500 tpd plant. Progress on the No. 45-compartment production shaft is good and if development on the 1300 bottom level is up to expectations, the shaft will be deepened by another two or three levels.

Consolidated Bellekeno Mines has completed a magnetometer survey on its iron prospect in the Mount Wright area. Anomalous conditions were indicated and diamond drilling has been recommended as a follow up.

New Hosco Mines has drawn up plans for work on its Mattagami area property. Ground magnetometer survey will be carried out to check anomalies indicated by airborne work. It's expected that diamond drilling will be started as a follow up in the spring.

NEWFOUNDLAND

British Newfoundland Exploration, wholly-owned subsidiary of British Newfoundland Corp., has started underground work on its uranium prospect in

They're Drilling Dolomitic Limestone In Eastern Missouri Lead Mine

The picture above, taken in a lead mine in southeastern Missouri, shows the positioning of a blast hole in medium-hard dolomitic limestone. The holes, made with Bethlehem Hollow Drill Steel, have an average depth of 10 ft.

In this lead belt, the ore bodies occur principally in the lower half of the Bonne Terre dolomite, which attains a thickness of nearly 400 ft. The stopes are horizontal and vary in height from 8 ft to 40 ft. Mining progresses by the room and pillar method, leaving open stopes. The $\frac{7}{8}$ in. Bethlehem Hollow Drill Steel is used in jackhammers and jumbos equipped either with one-use steel bits or carbide-insert bits.

Bethlehem Hollow Drill Steel is a good performer in all kinds of rock drilling jobs because it is rolled from fatigue-resistant steel, and has a uniform, centrally located hole. Bethlehem Hollow also has a wide quenching range. It is easy steel to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

Bethlehem Hollow Drill Steel is furnished in Carbon and Ultra-Alloy grades in rounds, hexagons and quarter-octagons. It comes regularly in lengths of from 18 ft to 27 ft, though longer lengths can also be supplied. Specify Bethlehem Hollow the next time you order drill steel.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL

EXIDE-IRONCLAD BATTERIES

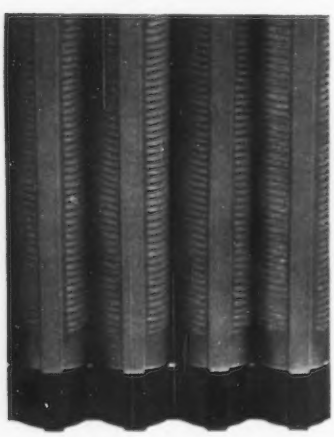
—best buy for the long haul

More ton-miles per dollar—that's the reason most cost-conscious mine operators prefer Exide-Ironclad Batteries for mine locomotives.

Experience has proved over the years that no other battery make matches Exide-Ironclad for average life in service and tonnage hauled. Rating for rating and dollar for dollar, Exide-Ironclad gives you more real value . . . more return on your investment.

Today's Exide-Ironclad features improved tubular construction, making it even better than the models that chalked up the industry's records. So you can expect even longer life potential and superior performance.

Total work output, not mere price, is the key to battery economy. When you buy batteries, specify Exide-Ironclad and get the most production capacity your dollar can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.



High-capacity, long-life tubular construction. Gives positive plate one-third more surface area for greater power reserve. Power tubes hold active material securely for long battery life.

Exide®

Newfoundland *(Continued)*

Labrador's Kaipokok concession. The ore-bearing structure has been probed by diamond drilling over a length of 1,400 ft. In all, 27 holes were put down at maximum vertical depth of 500 ft. Ore intersections were obtained in 14 holes. Aggregate length of orebody about 700 ft with 5 ft average width. Grade averages about 1% uranium oxide per ton. A 500-ft adit is being opened to intersect ore zone.

Shaft work is being carried out on Coast Copper Co.'s Little Bay property. Present plans call for sinking of a 3-compartment production shaft to 1500 ft. Exploration work has indicated 2-million tons averaging 2.1% copper per ton with an additional estimated 216,000 tons of previously mined ore on old dumps, grading 1.48% copper. New Highbridge Mining and O'Brien Gold Mines are participating in financing the company.

MANITOBA

Hon. F. C. Bell, Minister of Mines & Natural Resources, Manitoba, reports that 1957 was Manitoba's most active prospecting year and one of the most successful in mining development. Over 20,000 mining claims were recorded, compared with 14,712 in 1956.

New Manitoba Mining & Smelting Co. reports that installation of equipment for its 1,000 ton copper-nickel concentrator at Cat Lake is about 85% complete. All mine development work has been completed and a small electric smelting unit will round out the plant.

Lacwin Mining Co. will carry out detailed geophysical surveying and diamond drilling on its 200,000 acre Lake Winnipeg concession. Aerial magnetic and ground electromagnetic surveys conducted last winter at quarter mile intervals indicated some 27 anomalies.

Canadian National Railways will construct a 52 mile rail line from Optic Lake to Chisel Lake to service Hudson Bay Mining & Smelting zinc and copper deposits now being developed. It's expected that ore will be moving to the mill at Flin Flon by 1960.

Montgary Explorations is negotiating for the sale of pollucite ore containing cesium. Company's Bernic Lake lithium orebody contains a pocket of some 100,000 tons of pollucite with an overall cesium content of 28%.

BRITISH COLUMBIA

Estimated value of 1957 mineral production in B.C. was $165-million; down $25-million over 1956.

Largest reduction was in copper output, which was a third less than 1956. Value of copper was less than half the previous year's total, largely because of declined market prices.

Moderate declines in silver, lead and

Here's why WEST END can recommend the right product for your special application immediately!

When you phone requesting data on a specific application of a WEST END product or the development of a product to meet new specifications, the Sales Office Manager in Oakland with whom you speak can contact the plant at WEST END immediately. He talks by private wire teletype with the Plant Manager and the Director of Development. An answer is given immediately. It is relayed to you often while you are still on the phone.

WEST END 's Sales Office Manager sales representatives and plant executives work together as a team manning a system that is, in our opinion, uniquely outstanding in the chemical industry. Their confidence in the efficiency of this system is reflected in the enthusiastic, helpful and friendly manner in which they promptly serve you . . . our customers.

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SODIUM SULFATE
BORAX • HYDRATED LIME

Interior of a Hardinge 11½′ x 12′ Rod Mill with 85-ton rod load, 1000 horsepower.

Hardinge
ROD MILLS

Sizes range from 2′ to 11½′ shell diameter and up to 1000 horsepower.

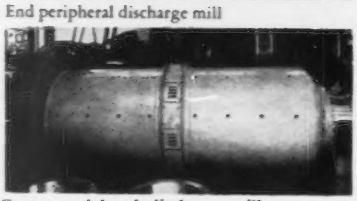
Types include trunnion overflow and peripheral discharge for both wet and dry grinding.

Applications include both open and closed circuit arrangements for ores, aggregates, concrete sand, cokes, and abrasives.

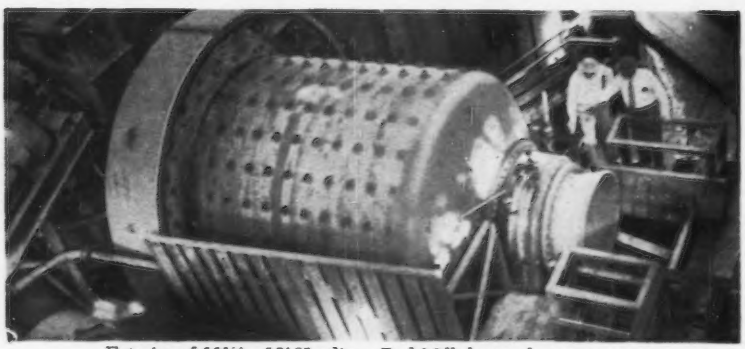
Complete specifications on request. Ask for Bulletin 25-C-1.

Trunnion overflow mill

End peripheral discharge mill



Center peripheral discharge mill



Exterior of 11½′ x 12′ Hardinge Rod Mill shown above

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COMPANY, INCORPORATED

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B.C. *(Continued)*

zinc output were also due to lower prices.

Increased output of lode gold reflected Bridge River areas output boost and offset reduction in gold produced as a by-product of copper, lead and zinc mining.

Output of industrial minerals was boosted by increased production of asbestos and sulphur. A moderate increase in structural materials was due mainly to larger output of Portland Cement.

Estimated values are as follows with 1956 figures bracketed:

Gold lode and placer $7,275,000 ($6,713,000); silver $7,000,000 ($7,511,000); copper $7,600,00 ($17,251,000); lead $39,150,000 ($44,702,000); zinc $48,100,000 ($58,934,000); iron and tungsten $7,900,000 ($8,542,000); by-product metals including antimony, bismuth, cadmium, indium and tin $5,600,000 ($5,784,000); industrial metals, including gypsum, sulphur $12,400,000 ($10,390,000); structural materials including clay products, lime, limestone and cement, rock and building stone, sand and gravel $21,400,000 ($20,587,000); coal $7,750,000 ($9,346,000).

Cowichan Copper Co. Ltd. put its ore-crushing mill into operation in December and by February the company expects to be producing 1-million tons of ore a month.

Annual report (Dec. 28) estimated production costs at 17.25c per lb copper. Mine report shows drifts, crosscuts and raises totaling 15,107 ft up to Nov. 30, and diamond drilling 53,116 ft. Broken ore for milling at the surface totals 10,400 tons at 2.05% or 426,720 lb copper, and underground, 17,000 tons at 5.54%, or 1,885,520 lb copper.

Trojan Consolidated Mines Ltd. will be managed and supervised by Henry Hill and Associates of Vancouver when the company re-opens its Highland Valley property after winter shutdown. Present manager A.J. McClellan will leave his post, and Don Lamber of Atlas Corp. will join Trojan's board of directors. President T.H. Wilkinson reports talks are continuing between Trojan and a "substantial" mining company regarding development of the property.

Consolidated Mining and Smelting Co. may launch an iron-steel project at Kimberley, site of its Sullivan Mine, that could rival value of lead and zinc produced at Trail. James R. Mills, assistant manager of research division and chairman of the research board, said first step in the Kimberley project would be production of iron for foundry use, but that steel would be made if there is sufficient demand. He said markets would probably be found in Vancouver, Alberta and northwestern U.S.

A direct attack on the policies of Mines Minister Kenneth Kiernan, backed by demands for repeal of 1957 amendments to British Columbia's Mining Act, met with little success this week in Vancouver.

Tax and tenure amendments to the act came under fire during two hours

Simple, balanced design allows this 6-yd. Manitowoc Model 4500 drag to get over-flowing buckets right at the edge of the cut.

Bigger Bites

MANITOWOC DESIGN PUTS ALL THE POWER TO WORK

There's no wasted horsepower with a Manitowoc Model 4500. Intelligent design forethought has reduced power-robbing extra parts throughout this big capacity mining machine. In fact, there are only 15 gears and 8 sprockets! And *only working gears turn* . . . Manitowoc's exclusive slide pinion arrangement disconnects all others until their function is needed. Even many *small* excavators don't have simplicity of design like this!

Powered by a single diesel power package rather than a series of independent electric motors, the 4500 has the get up to go anyplace . . . unhampered by trailing electric power cables. There's no downtime due to the failure of delicate electric switches, control boards or miles of wires. Put more power to work in *your* mine with a fast digging, long reaching Manitowoc 4500 shovel or dragline. A call to your Manitowoc distributor will bring all the facts.

MANITOWOC ENGINEERING CORP. Manitowoc, Wis.

GREATER SPEED AND POWER—LESS DEAD WEIGHT

TRUE MOBILITY TO MAKE MINING PROFITABLE ANYWHERE

GREATER STABILITY PRODUCES FULL BUCKETS, LOWER GROUND PRESSURE

DRAG TRAVELS ANYPLACE WITH A LOW, LOW TRAVEL CLEARANCE OF ONLY 17' 2"

BONUS CAPACITY IN ANY MATERIAL—MANEUVERABILITY OF A SMALL MACHINE

SHOVELS 1 - 5½ YD.

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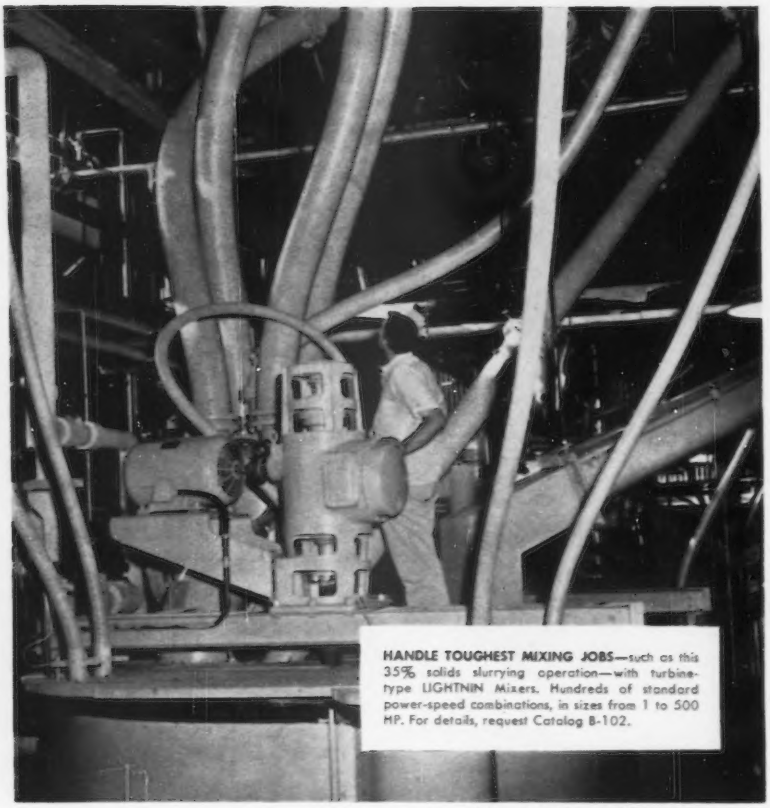
CRANES 20 - 100 TON



HANDLE TOUGHEST MIXING JOBS—such as this 35% solids slurrying operation—with turbine-type LIGHTNIN Mixers. Hundreds of standard power-speed combinations, in sizes from 1 to 500 HP. For details, request Catalog B-102.

International Minerals & Chemical Corp.

Get more out of your ore
with this kind of fluid mixing

The way you mix fluids can make a big difference in profitability.

More efficient processing, higher extraction values, lower costs—these results are *typical* for processors who take a good hard look at fluid mixing operations, and then specify LIGHTNIN Mixers.

Where to use LIGHTNINs

Here are some of the operations where fluid mixing with LIGHTNINs can pay off for you:

1. **Handling and blending ores** in pulp form, to increase throughput, tighten quality control.
2. **Conditioning feed** for flotation cells, with minimum power input.
3. **Leaching and dissolving** to get optimum removal of mineral values.
4. **Chemical reactions,** particularly those where high mass transfer rates are important.
5. **Controlling gas dispersions,** to get highest possible gas-to-liquid transfer rates.
6. **Mixing molten metal** for high-speed refining and alloying.

Results guaranteed

You can get LIGHTNIN Mixers to handle any of these operations efficiently—in sizes ranging from ¼ to 500 HP. *Results are fully predictable, unconditionally guaranteed.*

You can always get LIGHTNIN replacement parts when you need them. And there's a skilled LIGHTNIN Mixer representative near you—ready to help you get fluid mixing that *does what you want it to do.* For more facts, look him up now in Thomas' Register. Or write us direct.

Lightnin Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 234-b Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

B.C. *(Continued)*

of a stormy meeting called by Vancouver's Board of Trade, and attended by 300 members of the province's mining industry. Four industry representatives tore the controversial legislation to shreds and demanded that it be withdrawn, while the audience applauded in approval.

The adamant Mr. Kiernan said he was not considering a legislation withdrawal.

"I see little merit in jumping from one set of laws to another until we have a chance to see how they work out," the Minister said.

Speakers were: Dr. Desmond Kidd, consulting geologist and former president of the Canadian Institute of Mining and Metallurgy; Lionel P. Kent, a mining taxation expert; Charles Mitchell, secretary of the Commonwealth Mining Congress; and Dr. Howard T. James, professional engineer and managing director of Pioneer Gold Mines of B. C. Dr. H. C. Gunning, dean of the faculty of applied science at the University of British Columbia, moderated.

Under discussion were two bills passed last year which amended the mining act. One revoked the Crown system of land grants in favor of a lease system, the other provided for taxation of ore in the ground. Mr. Kiernan has stated that the tax is intended only for iron ore.

IN LATIN AMERICA

MEXICO

1957 Mexican metal and mineral production (metric tons)
First nine months of 1957

			Value
Zinc	**174,937**		$49,335,600
Lead	**159,440**		53,733,520
Tungsten	**151**		390,160
Copper	**47,803**		31,605,680
Antimony	**3,787**		3,006,320
Gold	**8,310,514**	**grams**	9,262,640
Silver	**1,090,792**	**kilos**	31,950,400
Selenium	**56,892**	**kilos**	1,510,000
Graphite	**18,705**		**976,760**
Manganese	**63,241**		8,398,320
Mercury	**614,903**	**kilos**	4,556,960
Iron ore	**425,169**		9,380,160
Tin	**328**		713,280
Arsenic	**3,483**		423,440
Cadmium	**610**		2,282,400
Bismuth	**331**		197,600
Sulphur	**718,548**		16,526,604*

* Estimated average price $23 a ton

ARGENTINA

For the first time, uranium has been shipped from the U. S. in oxide form, and the Argentine Atomic Energy Commission (CNEA) was its receiver.

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Argentina (*Continued*)

Eighty pounds of U_3O_8 —20% enriched by U-235—were sent to fuel Argentina's nuclear reactor. According to CNEA, this is the first completed reactor in Latin America. It is of the swimming-pool type, with a 3,000 kw capacity.

CHILE

After almost two years of studies and estimates, the National Smelters Corp. finally decided to build a new copper smelter for reducing the output of Quintero's Central Zone, north of Valparaiso. It's expected to cost $8-million and that another $4-million in Chilean currency will be needed for the construction. A 35,000 metric ton electrolytic copper refinery, which was planned adjacent to the smelter, will not be built because of the lack of funds.

Mitsubishi of Japan plans to spend several million dollars in an iron mine located near Copiapo where they have been drilling for some months.

A group of American bankers and Chile's Compania de Acero del Pacifico (C.A.P.) have purchased the Algarrobo iron mines from the Dutch firm, Wm. Müller & Co. Acero will operate the mines and production is scheduled to begin in 1960.

VENEZUELA

Venezuelan metals production for the period of January through September 1957 totaled:

Iron ore (63% av content)	10,964,973 metric tons
Gold	2,117,492 grams
Manganese ore (38-45%)	23,662 metric tons
Copper ore (2%)	45,000 metric tons
Nickel ore (2%)	1,575 metric tons

BRAZIL

Brazilian production figures for the first half of 1957 were:

	Tons (metric)
Scrap iron	591,852
Ferro-chrome alloys	378
Ferro-manganese alloys	5,461
Ferro-nickel alloys	194
Ferro-silicon alloys	3,865
Ferro-silicon manganese alloys	762
Cast steel and iron	68,175
Steel ingots	737,331
Shapes	598,553
Alumina	11,516
Aluminum ingots	4,455
Arsenic	45
Aluminum shapes	3,087
	Kilos
Gold extracted from mines	1,899
Silver	5,381

Companhia do Vale do Rio Doce 1957 iron ore production was 3,045,022 metric tons while company exports for the same period totaled 2,976,261 metric tons.

An agreement has just been signed in Washington by Brazil's Ambassador, Amaral Peixoto, and Assistant Secretary of State, Inter-American Affairs, Roy Rubottom, for joint cooperation in surveying Brazilian uranium reserves.

IN AUSTRALIA

Here are the tentative 1957 production figures prepared by the Bureau of Mineral Resources. Final figures will be released in March.

Gold 1.1-million oz (a reversal of the trend displayed in the last two years. Due to the Federal Government subsidies to gold producers).

Lead Slightly in excess of 300,000 tons (first time ever). Smelter production of refined lead about 195,000 tons. Production of lead bullion at Mt. Isa Mines Ltd. (controlled by Asarco) was a record of 45,000 tons lead content.

Zinc Zinc concentrates 290,000 tons. Refined zinc 105,000 tons.

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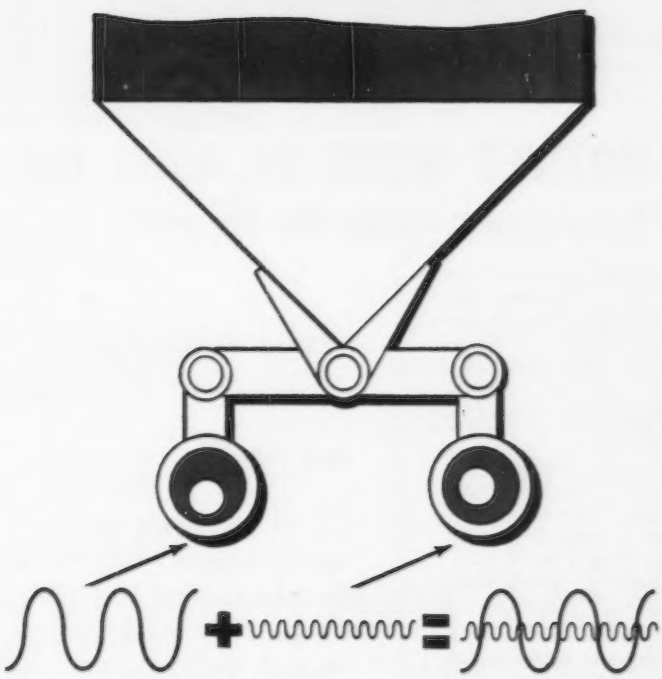

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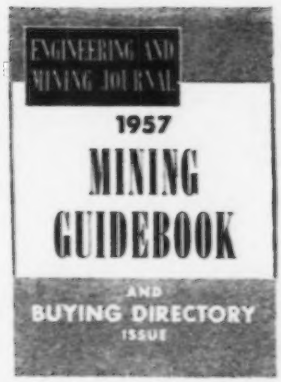

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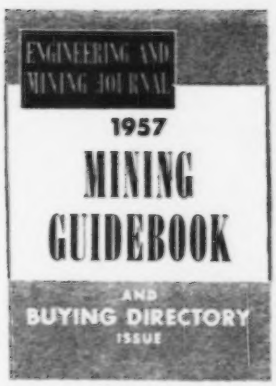

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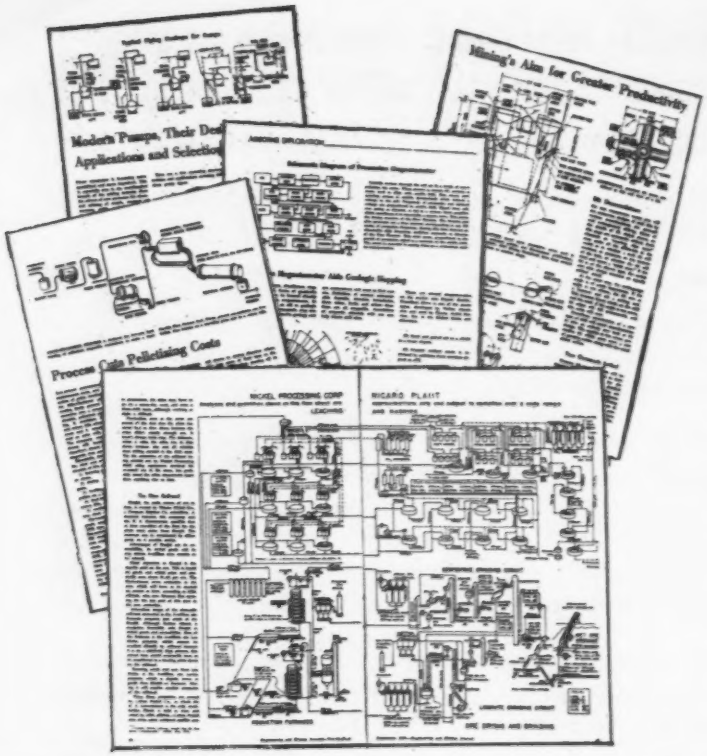
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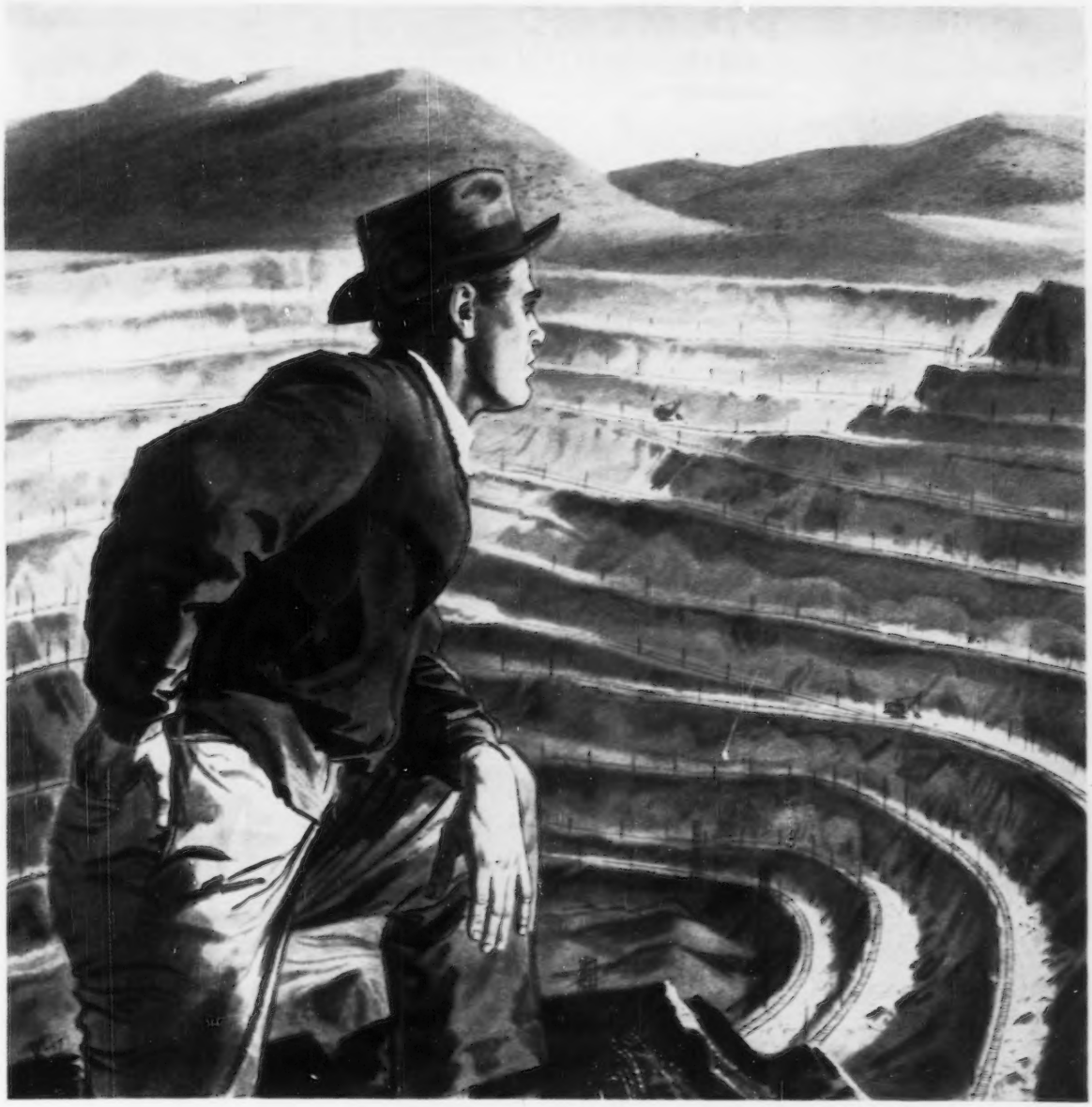

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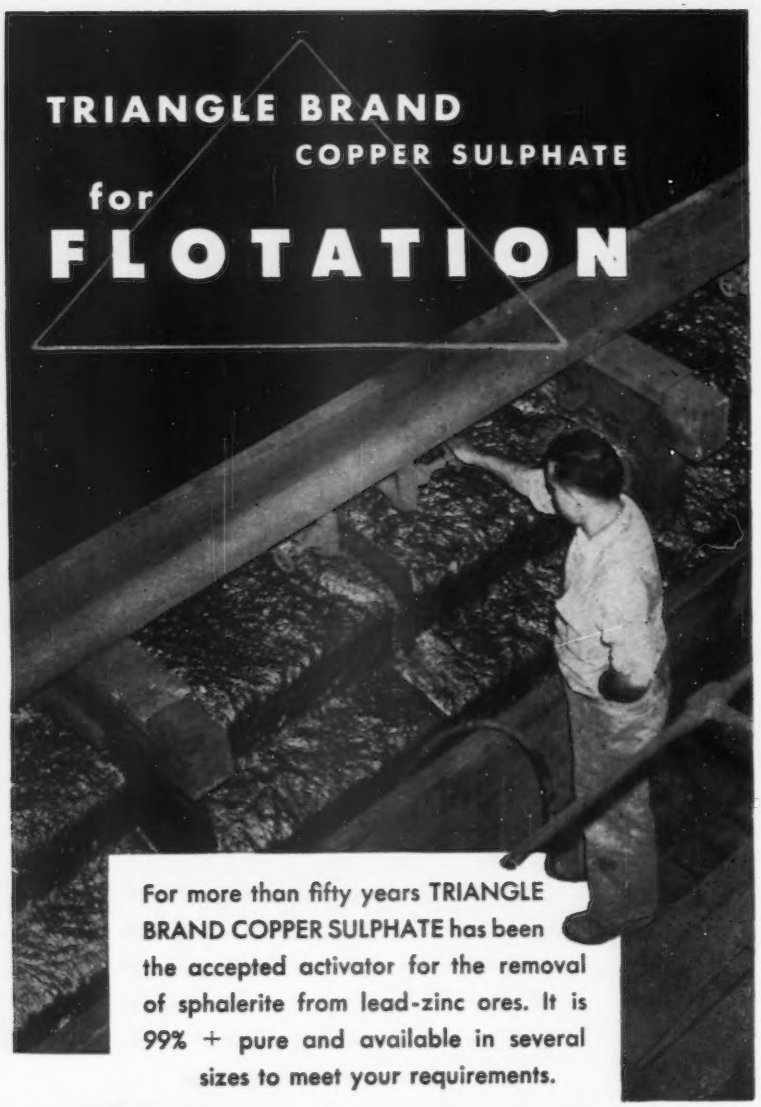

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Australia *(Continued)*

Copper Mine production 58,000 tons. Blister copper 52,000 tons and refined copper 33,000 tons.

Tin 2,100 tons in concentrates.

Iron ore 4.2 million tons.

Tungsten 2,050 tons.

Rutile 130,000 tons.

Illmenite 100,000 tons.

Zircon 90,000 tons.

Manganese 62,000 tons.

Asbestos 11,500 tons (most of it crocidolite)

Production of tantalite-columbite concentrates in Australia, currently running at a level of about 85,000 lb per year, will be greatly increased in the near future. Half of Western Australia's current output contains pentoxides of tantalum and columbium, and highest prices so far obtained in Western Australia were $3.80 per lb of pentoxide content for a concentrate containing about 60% of mixed pentoxides.

Increase in production will be due principally to interest shown by U.S. firms in Western Australian supplies.

Australian iron ore output, now in excess of 4-million tons per year will have to increase to cater to the expansion plans of local iron & steel industry. Known Australian reserves of high grade iron ore (more than 60% Fe content) would last approximately 40 years but experts hope that huge reserves of low-grade iron-bearing material, mostly in South Australia, will prove amenable to beneficiation. At present, a pilot plant is being constructed at Whyalla, South Australia to test on large-scale material from the Middleback ore deposits. A concentrate equivalent in iron oxide content to high grade ore had been obtained in preliminary tests. In Tasmania, Rio Tinto Co. of Australia is drilling the highly promising Savage River iron ore deposit.

Montana Silver Lead N.L. is to begin mining nickel ore for treatment at the Montana mill. Production of silver-lead concentrate is increasing but falling lead prices have affected the value of output.

Several Australian rutile producers who have sold their output, or part of it, on a long-term contract, have agreed to the requests of the overseas buyers and have adjusted the delivery dates to extend for a longer period. Australian experts expects a slight improvement in the rutile market in the latter part of 1958 but do not believe that prices will move up more than 10- or 15% at the most. New rutile prospecting in Australia is practically at a standstill and the industry at present is operating well below 75% mark of its capacity.

Continued low wolfram prices have attracted more miners to the Harts Range-Plenty River mica field in Central Australia and some increase in production appears to be inevitable. The industry has approached the government for assistance and for higher customs duties on imported material. A report from the government's Tariff Board is unlikely before the end of 1958.

Yieldable Arch provides 'safety valve' against squeezing pressures

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Yieldable Arches are easy to install; no special tools or fancy equipment is needed. Your own men can set them up and take them down with only a minimum of supervision. And that brings up another important point: Yieldable Arches are usually recoverable for reinstallation elsewhere in the mine. They frequently pay for themselves within the first year of service. One of our engineers will gladly give you full details on the Bethlehem Yieldable Arch.

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BETHLEHEM STEEL

Australia *(Continued)*

Associated Minerals Consolidated Ltd. expects a stronger demand for high-grade zircon and plans to replace some of its original machinery to increase it's zircon recovery rate. Quality improvements are also being planned and modifications are projected to increase the efficiency of both ming and treatment sections.

Drastic fall in the price of rutile forced Mineral Ventures N.L. to shelve its Evans Head project. Surveys indicated that the total quantity of area's material was about 15,000 tons of rutile and 28,000 tons of zircon. Prospecting for lithium, beryllium and allied minerals in South and Western Australia failed to disclose worthwhile deposits.

Production of concentrates by King Island Scheelite Ltd. fell only 84 tons to 1437 tons but the sharp fall in price of tungsten resulted in output's value dropping from £A2,486,845 to £A1,881,839. Figures are for fiscal years ended Oct. 31, 1957 and Oct. 31, 1956. The contract with U.S. interests is expiring in April 1958, and after that date, entire output will be sold on the open market.

Floyd Odlum's Atlas Corp. has sold its 50% share in North Australian Uranium Corp. N. L. for about $400,000 in cash to Aberfoyle Tin N. L., a local company.

Atlas' uranium venture reportedly proved too costly. The original price paid by Atlas for the shareholding was $1.26-million, and, since then, large sums were spent for uranium exploration.

Australian Aluminum Production Commission, which operates an aluminum-producing plant at Bell Bay, Tasmania, is pressing the Australian Federal Government for immediate reduction in the level of Australian aluminium imports.

Commission is suggesting that import licenses be issued only to cover the difference between total demand and local production.

Only relatively small export shipments have been made, mostly to Japan, and high Australian export prices make further export shipments unlikely. Imported aluminum is cheaper than the Australian product and marketing the domestic is difficult in spite of the fact that Australian demand for aluminium is rising.

Australian production figures for zircon in 1957 are certain to disclose a record output, but the Australasian Bureau of McGraw-Hill World News understands that a revision of production targets is being discussed and may be introduced early in 1958.

Zircon output from the East Coast of Australia is now running at a rate of about 90,000 tons per year. A plant for the extraction of zircon is about to come into operation on the Western Coast of Australia (Western Titanium N.L.) but overseas demand is reported to be considerably weakening and informed Australian sources are afraid that a position of over-supply has been achieved. It is pointed out, however, that ruling prices are still favorable to Australian producers and the proposed cutback in production should not be of great magnitude. It is most likely to affect more the new producers than those with established production and markets.

Australian reserves of manganese have increased by 36% in the past 18 months and further increases are expected.

This follows the Commonwealth government's decision to allow the export of a certain proportion of any new addition to manganese ore reserves. Decision boosted manganese exploration, particularly in western Australia, where several promising reserves have already been found in the Nullagine district.

Metallurgical grade ore is being exported to the U.S. and to Japan. Reserves are now in the vicinity of 800,000 long tons.

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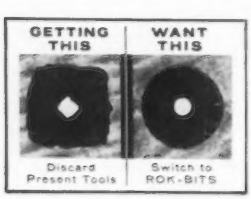

Brunner & Lay carbide Rok-Bits in these body types—cross, chisel, "X", cutaway, taper-socket. Furnished in standard wagon drill and hand held drill threads, also —600, 400, 200 and J-7.50 threads. Bit sizes up to 6½-in., in our Hole-Master. Write for new, FREE catalog No. 756.

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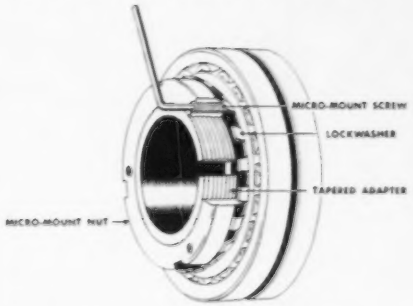
IN AFRICA

These are the Union of South Africa's 1957 metal mineral output figures (Jan.-Nov.).

	Production
Antimony (metric tons)	**16,652**
Chrome (metric tons)	**662,732**
Copper (metric tons)	**10,240**
Gold (fine oz.)	**15,629,494**

Exclusive MICRO-MOUNT



Fast and accurate mounting is made possible by the new Dodge Micro-Mount. The Adapter is snugged up with the Micro-Mount Nut. Mounting is completed by turning the Micro-Mount Screws against the Lockwasher until bearing, adapter and shaft form an integral unit.

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Africa (*Continued*)

Iron ore (metric tons)	2,081,642
Manganese (metric tons)	678,515
Nickel (metric tons)	4,381
Osmiridium (fine oz.)	2,865
Platinum (fine oz.) (estimate)	385,000 (estimate)
Silver (fine oz.)	1,374,777
Tin (metric tons)	2,553
Tungsten (metric tons)	286
Titanium (metric tons)	3,120
Zinc (metric tons)	14,726

Rail shipment of export manganese during the 12 months ended June 30, and the indicated truck supply for the current year, are the lowest since 1952 according to the review of activities by South African Manganese.

With the completion of the No. 2 shaft system at Harmony, Orange Free State, the management estimated that no further shafts would be required for a long time—possibly for as long as 20 years.

There are seven potential mines in the Transvaal and Orange Free State which could be floated over a period of three to four years for a total estimated sum of $200-million.

These are Zandpan (Klerksdorp area); two at Bethal; the J.C.I. Western Areas prospect near Randfontein; a block across the Vaal River, south of Vaal Reefs; an area adjoining the eastern boundary of the Lucas Block (all Transvaal) and the Erfdeel-Dankbaarheid claims in the OFS.

Harmony gold mine became the first mine in the Orange Free State to establish an underground twin connection between three vertical shafts when a hole-through between the No. 3 shaft and No. 2 shaft was completed.

Total production for uranium in South Africa during the first nine months of 1957 amounted to 8,177,172 lb, nearly one-third in excess of the figure for the comparable period last year.

Johnson, Matthey & Co., refining and selling agents for Rustenburg Platinum (Northern Transvaal) reduced the price early in December to $78-80 and $84-87 in conformity with the cut decided upon by Baker Platinum.

Apart from copper sales, which dropped by about 2.2-million tons, and a few other minerals which declined to an insignificant extent, sales of all South African minerals were up for the first nine months of 1957 and compared with the same period for 1956. Silver increased from 1,189,965 to 1,323,493 fine oz; tin went up from 703,770 tons to 877,765 tons; chrome ore increased from 484,346 tons to 558,987 tons, and manganese ore showed an increase of nearly 20% in value from £3,125,809 or $8,753,000 to £3,808,865 or $10,665,000) despite a small decline in tonnage sold.

South-West Africa's metal production for the first eleven months was:

	Production
Copper (metric tons)	1,572
Lead (metric tons)	3,884
Lead-vanadium concentrates (metric tons)	3,370
Lead-copper-zinc concentrates (metric tons)	225,947
Manganese (metric tons)	79,447

Broken Hill Mine in Northern Rhodesia will shortly close its new lead smelter as a result of production cuts and the sharp drop in world lead prices. Mine which produces lead, zinc and a small quantity of vanadium, will reopen its original smelting plant which went out of production when the new plant was put into commission. This decision has apparently been taken because the old plant is adequate to deal with the present reduced production from the mine and can be operated at lower costs than the more modern plant.

Anglo-American Corp.'s Kansanshi Mine in Northern Rhodesia, which was flooded last month, has announced that all its employees have been placed at other Copperbelt mines. The Kansanshi Mine itself now stands deserted — pumping having been abandoned when engineers reported that to de-water the mine and continue development would involve high capital cost which at present world copper prices might not be economically justifiable.

Photo - Courtesy, United States Steel Corporation.

Tough cars for a big job . . .

In 65 years or so the first dipper hole at Mesabi has grown to the tremendous open pit pictured here in part. Differential Air Dump Cars first put in appearance at Mesabi in 1925. Veterans of many years and thousands of tons, these cars have carried their loads uncomplainingly. Steady reorders have a pleasant way of nodding approval. We would be glad to tell you more about Differentials — how they're made and why you'll like them.

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6 7 **DOUBLE-PACKED WALLOP**—Bridge wire extends into the priming charge and makes positive contact to give rapid ignition.

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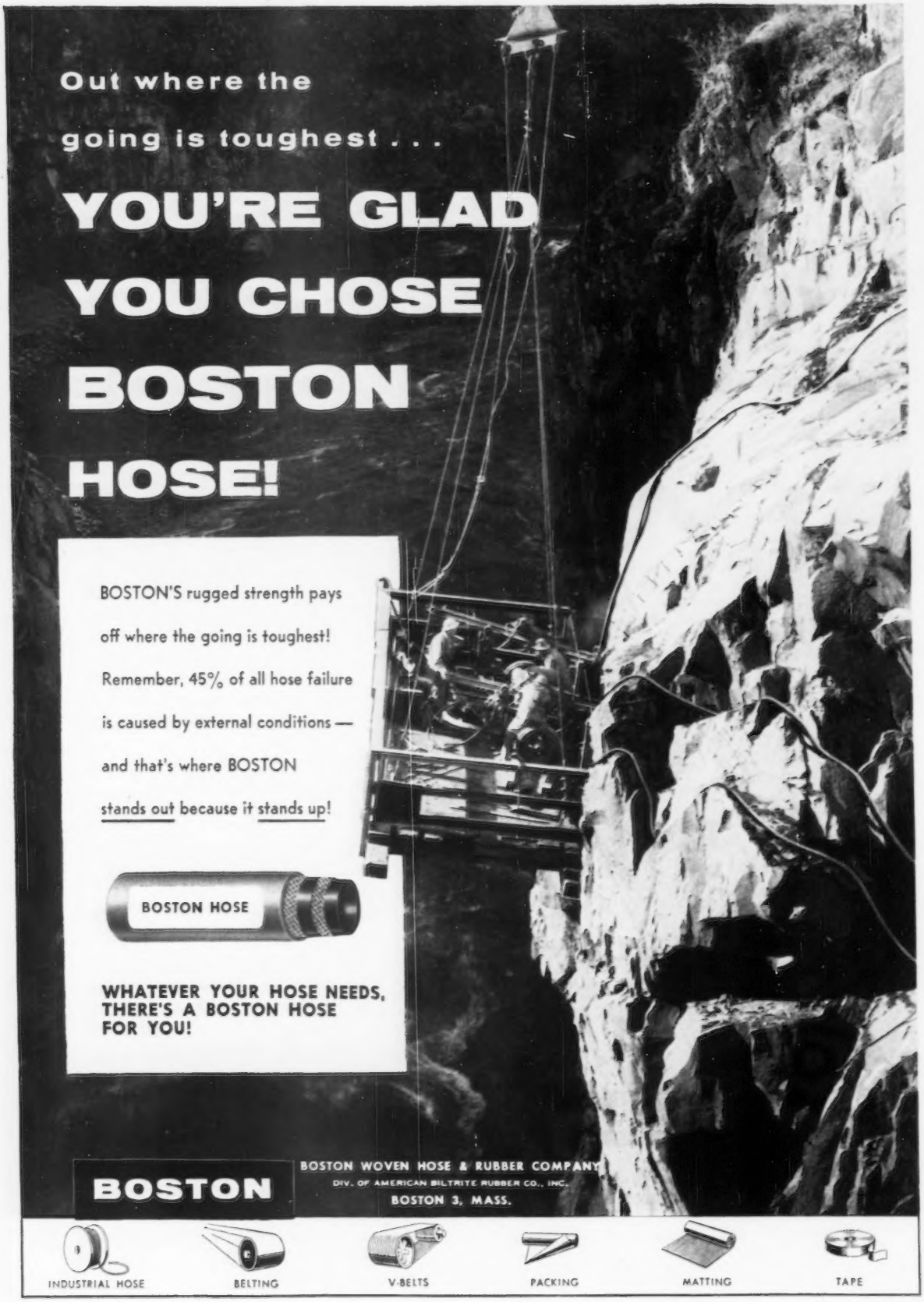
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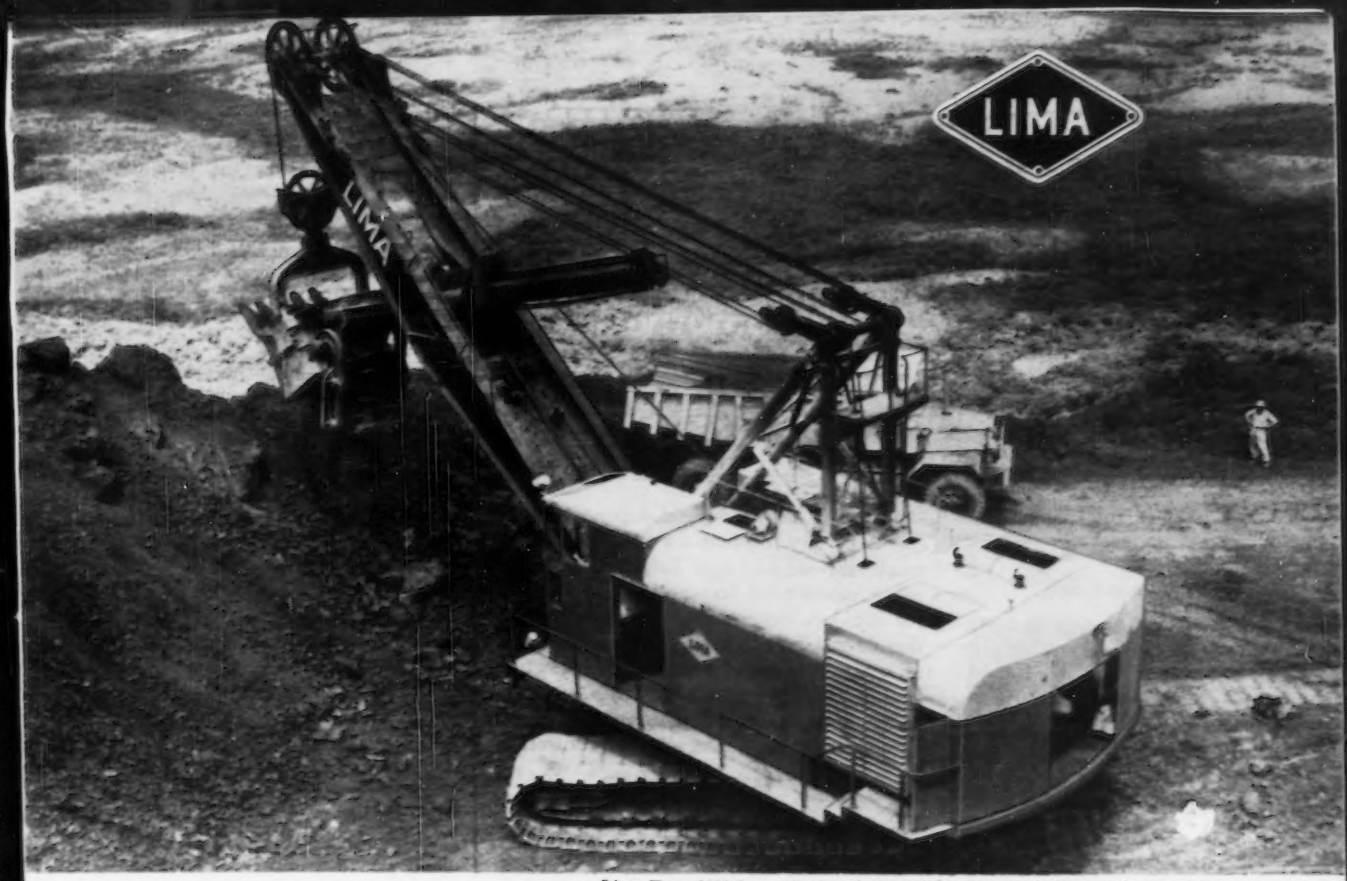

Lima Type 2400 6-cu. yd. shovel at work loading ore in Venezuela iron mine.

THE LIMA TYPE 2400...
muscled for the big mining jobs

Quality does pay off. As hundreds of mining operators have found, Lima's extra engineering features and precision construction mean greater tonnages, higher profits.

When the going is tough, there is no substitute for these Lima Type 2400 quality features:

Crawlers are wide and long for generous ground contact and ease of handling.

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Drums are extra wide, with large diameters . . . advantageous when operating as a dragline, crane or high-lift shovel, because of greater cable capacity.

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Lima Type 604 1½-cu. yd. shovel and Lima Type 1201 3-cu. yd. shovel loading iron ore on Mesabi Iron Range.

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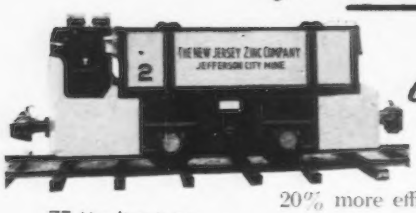

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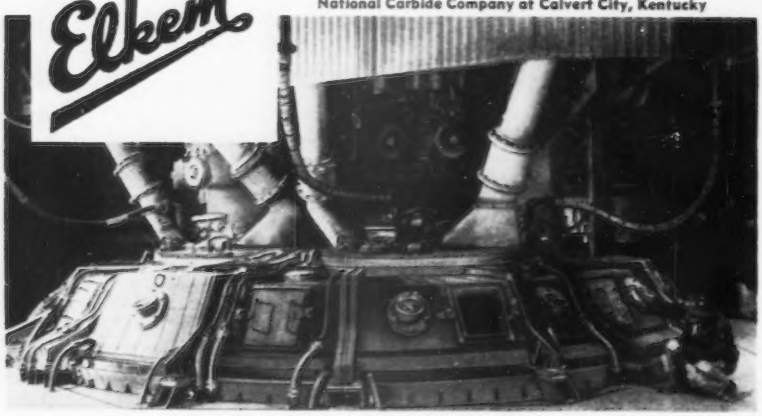

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Africa *(Continued)*

A new world record for shaft sinking has been claimed by the Free State Saaiplass Gold Mining Co., South Africa.

Working on a three-shift basis, 262 men, during a 30-day period, deepened the shaft by 834 ft (from the 199 level to the 1,033). Lined with concrete for 810 ft, shaft is said to exceed the previous record by 71 ft.

A new geological laboratory has been opened in Salisbury, Southern Rhodesia, by the Rhodesian Selection Trust group of companies.

Cyril Hatty, Colony Minister of Mines, said that this represented one of the finest developments in the whole mineral history of Southern Rhodesia. Until very recently the colony had not made much progress in mineral research, he said.

Present capacity at Western Holdings reduction plant (125,000 tons monthly), will be increased at the end of this year. This extension is planned to provide for treatment of tonnage from the No. 3 shaft area. The mine will ultimately provide mill feed at a rate of about 150,000 tpm. No. 3 Main shaft, which reached depth at the end of November, will be completed by about June 1958.

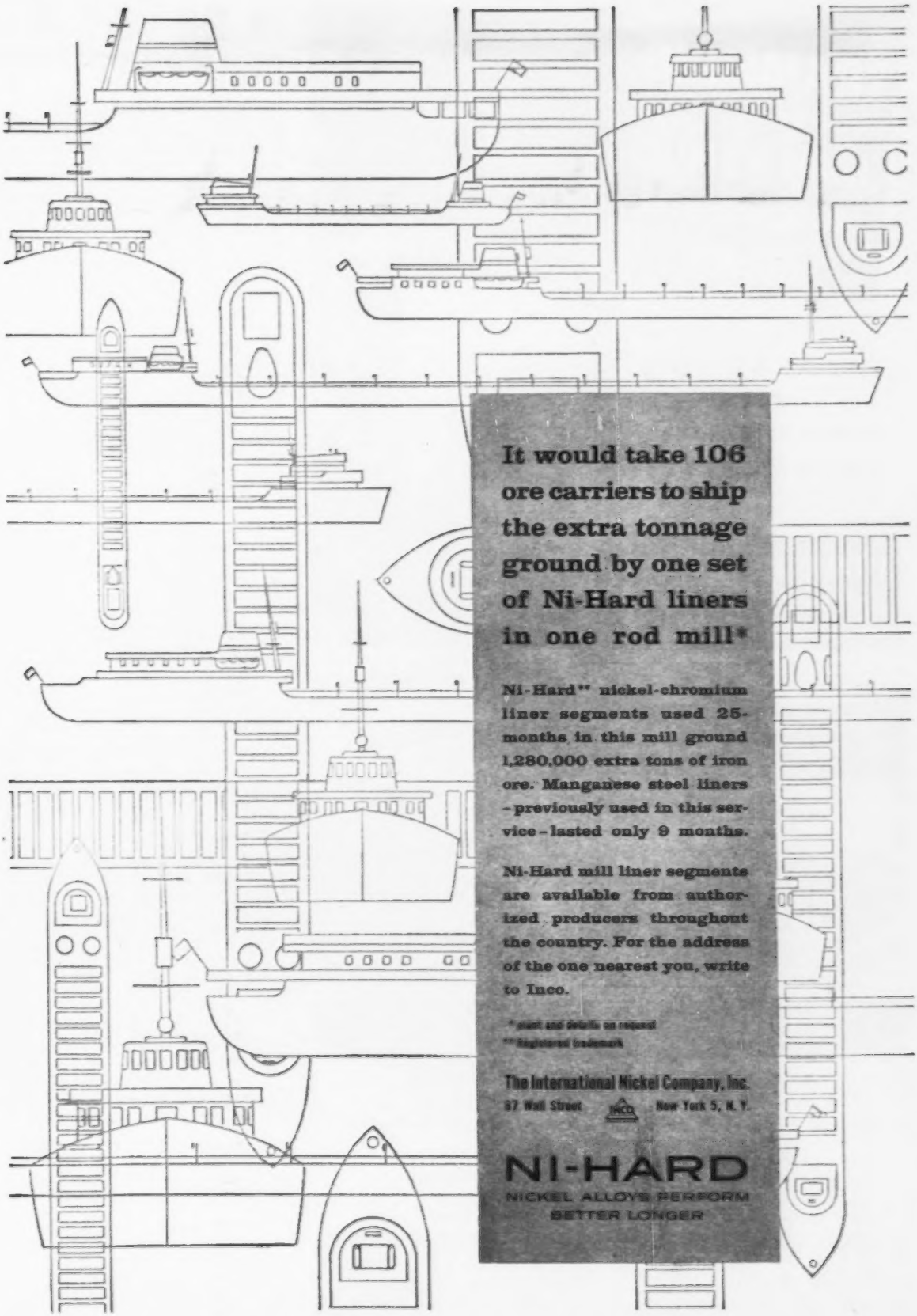
Algerian Mining Research Bureau recently said that exploration teams have found deposits of diamonds, platinum, nickel and copper in the Sahara. The Bureau said the finds were made during a three-month search in the mountainous Hoggar region, 1250 miles due south of Algiers. So far the Bureau said, five small jewel diamonds and one large industrial one have been picked up.

Hoisting equipment and all auxiliary installations necessary for shaft sinking have been installed at the Riebeeck Gold Mine in the Orange Free State.

Birch Bernstein, chairman of the company, told shareholders at the annual meeting that full-scale shaft sinking is expected to start before the end of the year.

A fairly promising discovery of uranium and thorium has been found in the Northern Province of Nyasaland, according to the director of Geological Survey. Specimens of ore from Lomba Hill, north of Fort Hill, have been sent to Zomba and Britain for further analysis. At the same time, thorium-bearing sands are being prospected at Monkey Bay and on the east coast of Lake Nyasa. In the Mwanza area, near Tambani Mountain, New Consolidated Gold Fields Co. is carrying out an extensive search for radioactive minerals.

While there is no immediate move towards dewatering the flooded Kansanshi Copper Mine in Northern Rhodesia, investigations are continuing into methods of treating the oxide reserves to allow exploitation on a profitable scale. Leaching with sulphuric acid may prove the most economic technique in the case of higher-grade ore.



It would take 106 ore carriers to ship the extra tonnage ground by one set of Ni-Hard liners in one rod mill*

Ni-Hard** nickel-chromium liner segments used 25-months in this mill ground 1,280,000 extra tons of iron ore. Manganese steel liners – previously used in this service – lasted only 9 months.

Ni-Hard mill liner segments are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco.

* [illegible] and details on request

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IN THE PHILIPPINES

Atlas Mining and Development Co., largest copper producer in the Philippines, has signed a new contract in Tokyo with Mitsubishi Metal Co. for doubling Toledo mine's copper output. Effective May 1958 to April 1962, a $2.5-million loan (in part cash, in part for import of machinery to Atlas) will be supplied by the Japanese Import-Export Bank, aided by private banks, which will serve as advance payment on copper to be imported from the Philippines.

Under terms of the contract, Atlas will supply Mitsubishi with a maximum of 8,000 tons at *E&MJ* prices. Osaka Metal Refining Co. will produce 1,000 tons of wire per month to supply unfinished wire to the Phelps Dodge Copper Products Co. of the Philippines.

Itogon mill at Baguio treated 17,695 tons last October for a recovery of 2853 oz gold averaging 0.16 oz gold per ton. October production was the highest in the last 21 months of operation.

November production of Atlas Mining & Development Co. was 6,299 tons of concentrates at the Toledo mill, containing 3,312,833 lb copper and 781 oz gold, from 335,394 tons of ore milled. Ore grade averaged 0.64% copper. Total value of November shipments was $787,000. A continuing water shortage throughout the month accounted for the reduced production. Additional pumping capacity is being installed and will be in operation by mid-December. Total milling days of operation numbered 26 in November.

Lepanto Consolidated milled 37,260 tons last November and produced 4,702 tons of concentrates, containing 2,438,450 lb copper and 3968 oz gold. Average copper content of the ore was 3.4% and average gold content 0.134 oz per ton.

Paracale Gumaus, only operating mine in the Paracale district, milled 6174 tons last October, making a bulk concentrate containing 817 oz gold, 1,783 oz silver, 2267 lb lead and 20,449 lb copper.

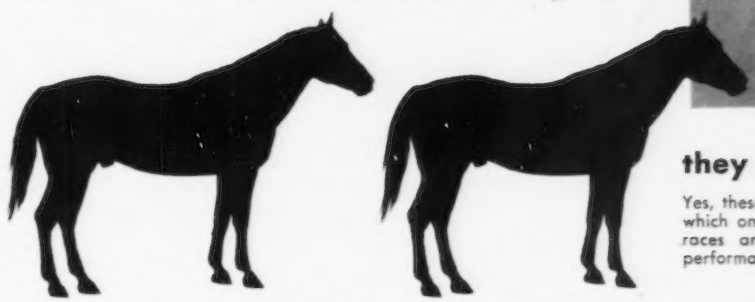
IN THE FAR EAST

MALAYA

Malayan tin exports in 1957 amounted to 70,604 tons, lowest in the past three years. Exports in 1956 totaled 73,276 tons while in 1955, the figure was 71,161 tons.

December's total of 4,766 tons was the lowest in two years. More than half of this (2,400 tons) went to the United Kingdom. U.S. bought 1,130 tons. Of the year's total, U.S. bought 36,116 tons, Great Britain—6,532 tons, Europe —

take the SPECULATION out of SPECS with MARCY®

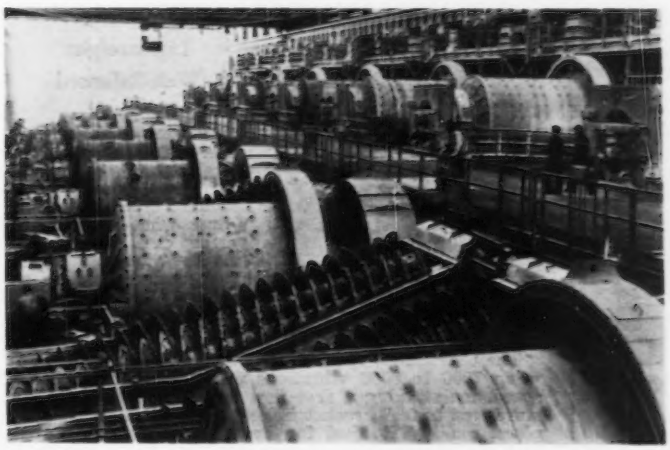


they may look alike!

Yes, these two quarter horses do look alike! But, which one has the breeding and training to win races and a proven record of championship performance?

Grinding Mills Specs May Read Alike, too!

Yes, grinding mills may look alike...manufacturer's specifications may read quite similar. But, which manufacturer has the specialized **grinding** experience, the engineering, the manufacturing "know-how," to build **grinding mills** with a **proven** record of outstanding performance? Which manufacturer is willing to show you the real specifications behind the proposal?



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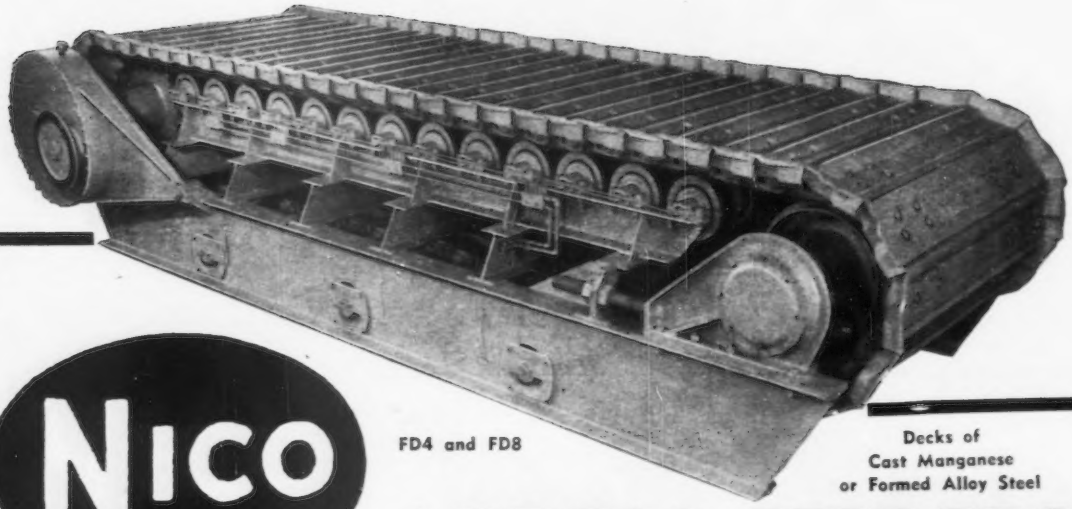

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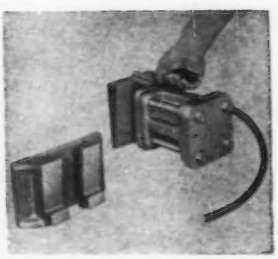

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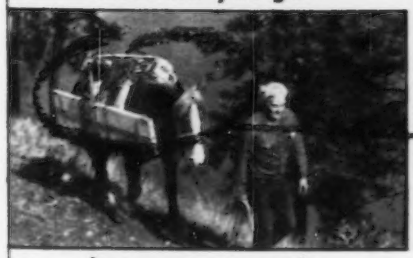

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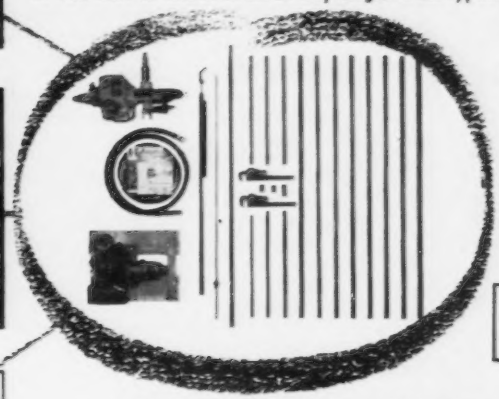

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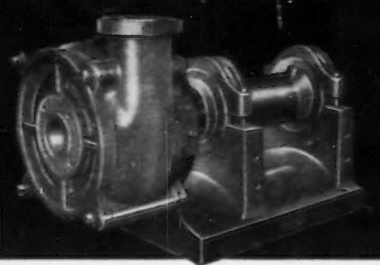

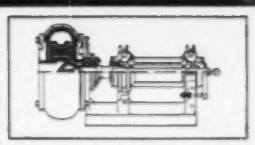

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Malaya (*Continued*)

6,834 tons, British Possessions — 8,464 tons, and other countries — 12,658 tons.

INDIA

Prices of Indian manganese are dropping fast. Current price of superior grade ore — 46 to 48% — is being quoted at $50 per ton instead of the $52 quoted a short while ago. Reason for the drop is the absence of manganese ore demand from abroad.

Trade representatives report that they're asking the Indian government to provide positive incentives for increasing manganese exports. The representatives are reportedly asking the government for: (1) Removal of export duty on medium grade ore; (2) Abolition of the quota system; (3) An explicit and clear export policy to hold good for five years.

IN EUROPE

ITALY

Italy will no longer spend $6.4-million a year to import 50,000 tons of potash for fertilizers. Montecatini has started work on a new factory near Campofranco, Sicily, which will transform kyanite into potassium sulfate fertilizer. The kyanite will be mined from a rich saline lenticular mass discovered recently by Montecatini experts near Bosco, Serradifalco, Sicily.

Fertilizer plant capacity will be 350 tpd with production expected to start early in 1959. Surplus fertilizer will be exported.

Professor Felice Ippolito, Secretary General of the National Commission for Nuclear Research, has released data indicating that Italy should be producing 65 tons of uranium metal annually by 1960.

The estimate is based on surveys conducted over the past three years which indicated deposits of "some importance" in Piedmont, the Aosta Valley, Lombardy, the Alto-Adige, Calabria and the Island of Sardinia.

Ores found in the western Alps (Piedmont) indicate the "certain" presence of 100,000 tons of 0.15% U-308 equivalent to 110 tons of metallic uranium, Prof. Ippolito announced.

A government-sponsored bill, calling for an $800,000 radioactive minerals exploration program, will soon be introduced in the Sicilian Regional Assembly. Surveys will be undertaken jointly by National Institute of Geophysics and the Sicilian Region.

CZECHOSLOVAKIA

Assisted by Soviet chemists, Prague's Mining Industry Research Laboratory

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Czechoslovakia *(Continued)*

claimed that aluminum can be produced without the need of bauxit as the raw material basis. 'We are now solving the problems connected with the production of aluminum from non-bauxite raw materials' a Prague dispatch stated on Nov. 11, 1957.

USSR

Large quantities of rhenium have been found in Kazakhstan copper deposits.

A Soviet weekly, reporting the discovery, said there were "sufficient quantities of rhenium to make Kazakhstan the world's leading producer of this metal."

FINLAND

Otanmaki Inc., in a desire to make Finland self-sufficient in steel production, is laying plans to build an iron works and rolling mill in northern Finland. Total cost will be about 58-milion, and probable site is somewhere on the Gulf of Bothnia. Annual production would be 100,000 tons of medium and thick plate plus 100,000 tons of thin plate. If preparation work begins in the fall of 1958, mill will be in production in 1961.

A new concern, Vourikemia Inc., was formed by five Finish mining, power and chemical corporations. The new firm will concentrate on chemical engineering in the mining and metallurgical fields and its first project will be to construct a factory to produce titanium dioxide.

HUNGARY

Ten more aluminum smelting furnace batteries were scheduled to go into operation in the two major Hungarian plants before the end of 1957, according to claims published in *Esti Hirlap* (a daily) Nov. 27, 1957.

The Tatabanya mill was to get five batteries (potlines) during November 1957, and was to get two more by the end of the year. Inota plant was to have three more batteries operating by the end of last December.

NEW BOOKS

Handbook of Rigging, by W. E. Rossnagle. Second edition. Covers all aspects of hoisting and rigging practice. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. Illustrated in 344 pp. Price $6.50.

American Civil Engineering Practice, Vol. III, edited by Robert W. Abbett. Covers sections 22 through 34—theory of structure. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $25.

Welding Handbook. Fourth edition. Pub-

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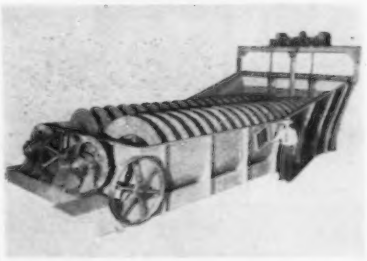

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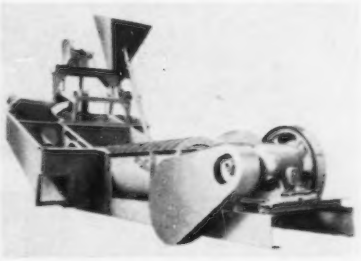

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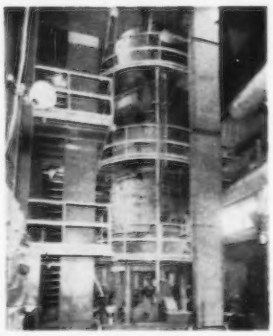

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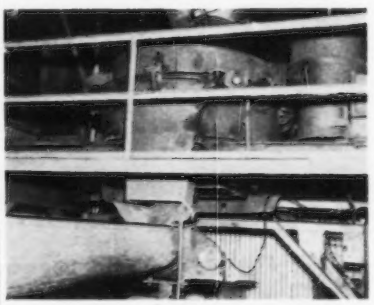

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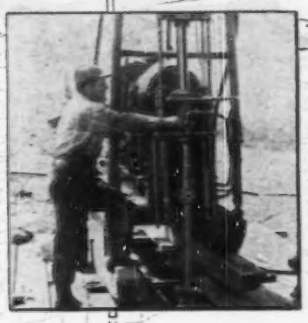

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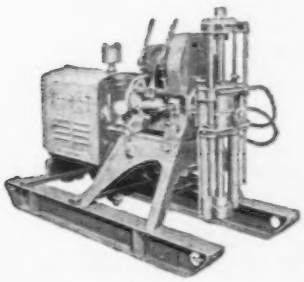

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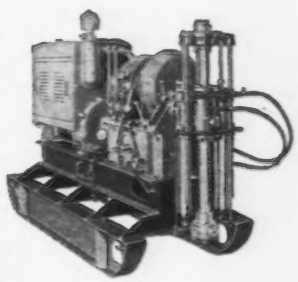

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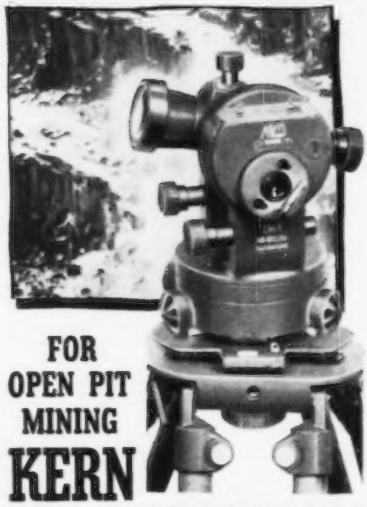

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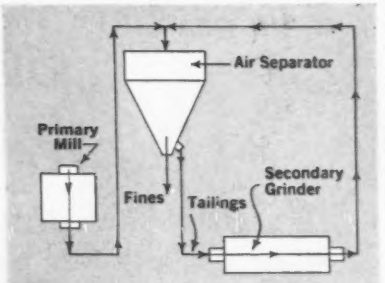

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New Books *(Continued)*

lished by American Welding Society, 33 West 39 St., New York 18, N. Y. 2,500 pp. Price $9.

Nuclear Chemical Engineering, by Manson Benedict and Thomas H. Pigford. Describes materials of importance to nuclear engineering of reactors; and the metal and mineral processing techniques in use to concentrate, purify and separate these raw materials. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. 572 pp. $9.50.

Centrifugal and Axial Flow Pumps. Second edition, by A. J. Stepenoff. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Very good. Illustrated in 458 pp. Price $12.

Boundary Control and Legal Principles, by Curtis M. Brown. For abstractors, surveyors, miners, prospectors, engineers and lawyers. Good. 264 pp. Price $7.50.

Financial Post Survey of Mines—1958. All active mining companies in Canada, as well as thousands of prospective or inactive companies, are listed as to officers, properties, stock activity and present plans. Eight year price range of stocks included. Also metal production since 1858. Map section shows details of 26 mining districts. Size is 9x12 in. 436 pp. Published by Financial Post Inc., 481 University Ave., Toronto 2, Canada. Price $3.

Engineering Materials Handbook, edited by Charles L. Mantell. A reference authority organized in 43 sections to consider materials from an enginering structure, machinery and equipment viewpoint. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. 1,936 pp. Price $21.50.

Tablas para la determinacion microscopica y rayos X de minerales opacos. La 2ª edicion ampliada por Alejandro Novitzky. La obra consta de: (1) tablas de minerales agrupados segun anistropia bajo nicoles cruzados y dureza de pulidura; (2) tablas de minerales agrupados segun color bajo nicoles paralelos; (3) tablas de reacciones microquimicas; (4) tablas de minerales agrupados segun elemento; (5) tablas reacciones de corrosion; (6) descripcion de reacciones de corrosion para cada mineral; (7) tablas de poders reflectores de minerales; (8) indice de espaciados; (9) tablas de espaciados para cada mineral. La impresion se realizo en los tallers graficos de la Universidad Tecnica de Oruro, Bolivia. Paper bond. 270 pp. 25x32cm. Precio $12. An excellent work—might be valuable in English as well.

Pump Operation and Maintenance, by Tyler G. Hicks. How to operate and maintain pumps. Published by McGraw-Hill Book Co. 275 pp. Illustrated. $9.

Specifications and Costs Data Book For Civil Engineers, Vol. II, by Elwyn E. Seelye. Third edition. Prices shown are based on *Engineering News Record's* construction cost index for easy interpretation. Published by John Wiley &

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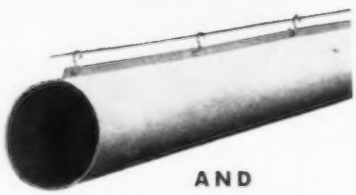

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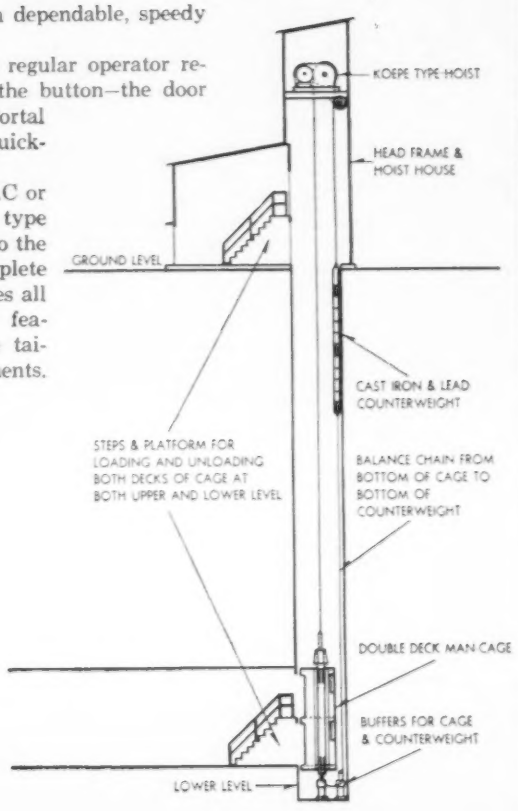
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Bulletin No. 72. Geology and Mineral Resources of the Gossan Lead District and Adjacent Areas in Virginia, by George W. Stose and Anna J. Stose (his wife and a registered mining engineer). Published by Dept. of Conservation and Development, Virginia Division of Mineral Resources, Charlottesville, Va. Illustrated in 240 pp. Maps.

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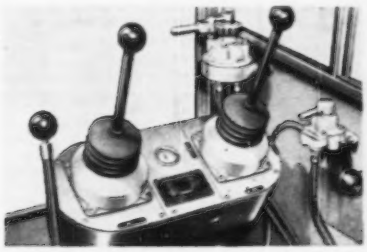

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THICKENERS

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1—50MNM4C I-R, 3-drum Slusher, 440 Volt
1—HDE-2 Sullivan, 2-drum Slusher, 440 Volt
5—EUA I-R 1-drum Tugger, Air
6—E-211 Sullivan, 1-drum Tugger, Turbinaire
1—D6UL, I-R 1-drum Tugger, air
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1 864 cfm Chicago Pneumatic 150 H. P.

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2 Mancha Electric Mule, 18" Guage
2 General Electric LSBE-204-B14 30" Guage

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1 Size 5 Allis Chalmers Gates
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2 Gardner Denver Model HK
2 Sullivan Model E-111
1 Ingersoll Rand Model D6UL

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1—50 HP Fairbanks-Morse
1—50 HP Vulcan
1—60 HP Box
1—75 HP Vulcan
2—100 HP Box
1—112 HP Vulcan
2—125 HP Ottumwa
2—150 HP Vulcan
2—200 HP Ottumwa
1—250 HP Ottumwa

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1—100 HP Webster, Clamp & Lane
1—150-200 HP Ottumwa

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1—Sullivan Model HA3
2—Ingersoll-Rand Model 10HR
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2—6 ton General Electric Locomotives
2—7 ton General Electric Locomotives
1—7 ton Atlas Locomotive
3—8 ton Ironton Locomotives
2—8 ton Goodman Locomotives
7—8 ton General Electric Locomotives
1—9 ton Whitcomb Locomotive
4—10 ton Atlas Locomotives

TROLLEY LOCOMOTIVES
1—2 ton Atlas Trolley
1—4 ton General Electric Trolley
2—6 ton Jeffrey Trolleys
1—6 ton Goodman Trolley
2—10 ton Jeffrey Trolleys
1—13 ton Goodman Trolley
1—13 ton Jeffrey Trolley
1—15 ton Jeffrey Trolley

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1—120 CFM Ingersoll-Rand ER-1, 8" x 6"
1—161 CFM Chicago Pneumatic PB-2, 9¼" & 5¼" x 5¼"
1—179 CFM Chicago Pneumatic NSB, 9" x 8"
1—179 CFM Ingersoll-Rand NE-1, 12" x 10"
2—293 CFM Ingersoll-Rand 10-B, 12" x 6½" x 10"
1—350 CFM Chicago Pneumatic TC-80A 11" & 9" x 11" High Pressure
1—364 CFM Sullivan WB-9, 10" x 9"
1—447 CFM Ingersoll-Rand 10-B, 14" & 7½" x 12"
2—965 CFM Ingersoll-Rand 10-B, 18" & 10" x 14"
1—1312 CFM Ingersoll-Rand 10-B, 21" & 12" x 16"

CLASSIFIERS
1—45" x 17' Akins Simplex Special Classifier
1—60" x 25'9" Wemco Simplex Screw Classifier
1—8' x 27' Dorr Duplex Rake Classifier
1—8' x 18'4" Dorr Duplex Classifier
1—6' x 32' Wemco Duplex Spiral Classifier
1—2' x 12' Wemco Simplex Spiral Classifier

JAW CRUSHERS
6—2¼" x 3½" New Morse Lab Crushers
6—4" x 6" New Morse Lab Crushers
1—6¼" x 7" Hendy Jaw Crusher
1—8" x 10" Rogers Jaw Crusher
1—8" x 15" Wheeling Jaw Crusher
1—9" x 16" Rogers Jaw Crusher
1—9" x 16" Universal Jaw Crusher
1—10" x 16" Universal Jaw Crusher
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2—3' x 4' Oliver Drum Filters
2—4' x 2' Morse Drum Filters
1—4' x 8' Eimco Drum Filter
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4—20 Cu. Ft. Rotary End Dump
180—20 Cu. Ft. Rocker Dump
5—25 Cu. Ft. Rotary End Dump
3—26 Cu. Ft. Side Dump Granby Type
3—27 Cu. Ft. Rocker Dump
12—28 Cu. Ft. Side Dump
6—54 Cu. Ft. Rocker Dump
12—84 Cu. Ft. Rocker Dump

LOADERS
2—Gardner-Denver Model 9 Loaders
2—Eimco Model 12B Loaders
3—Eimco Model 21 Loaders
1—Eimco Model 12 Loader
1—Joy Model HL3
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1—8" x 60" new Morse laboratory batch ball Mills
1—8" x 60" new Morse laboratory Rake Classifier
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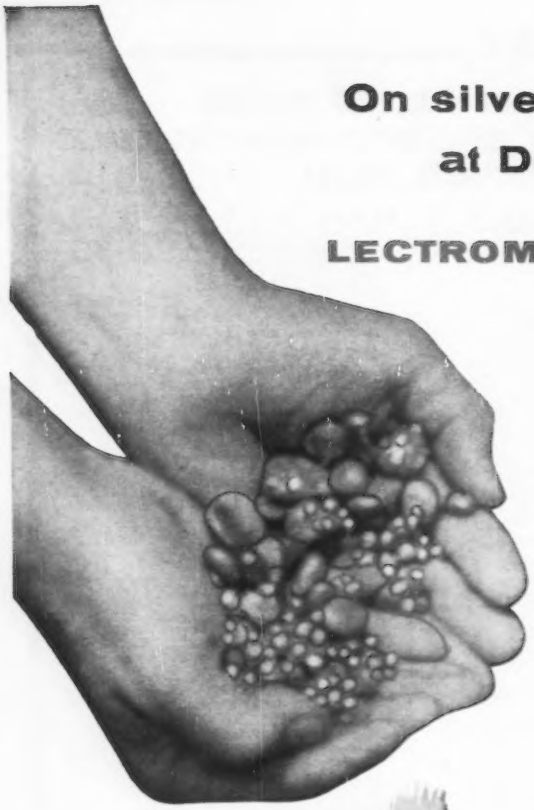

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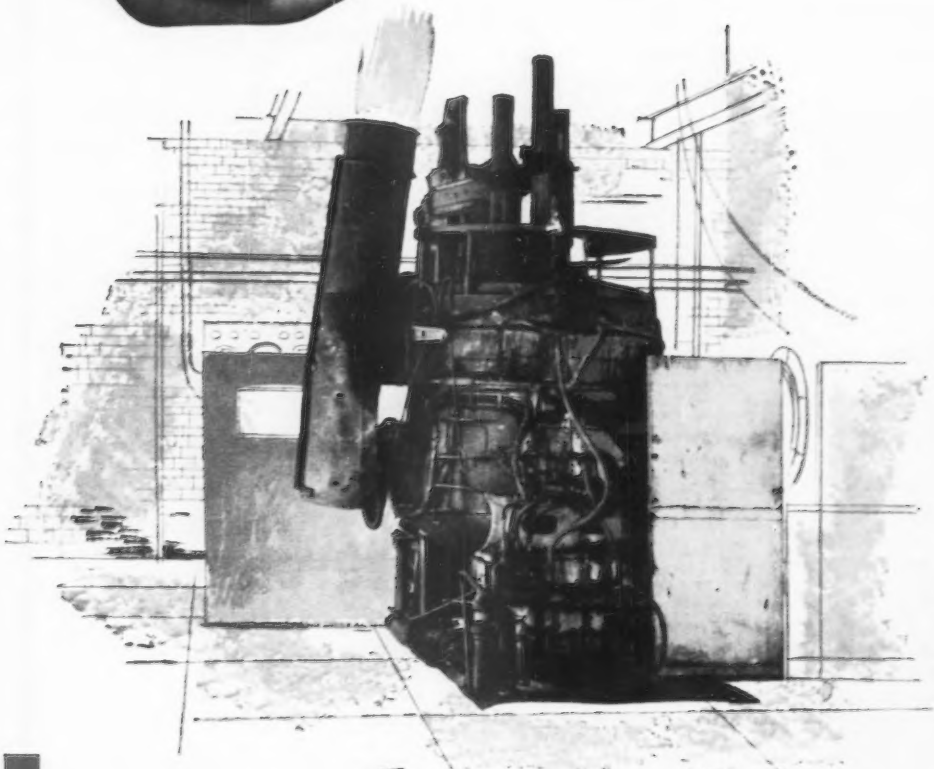

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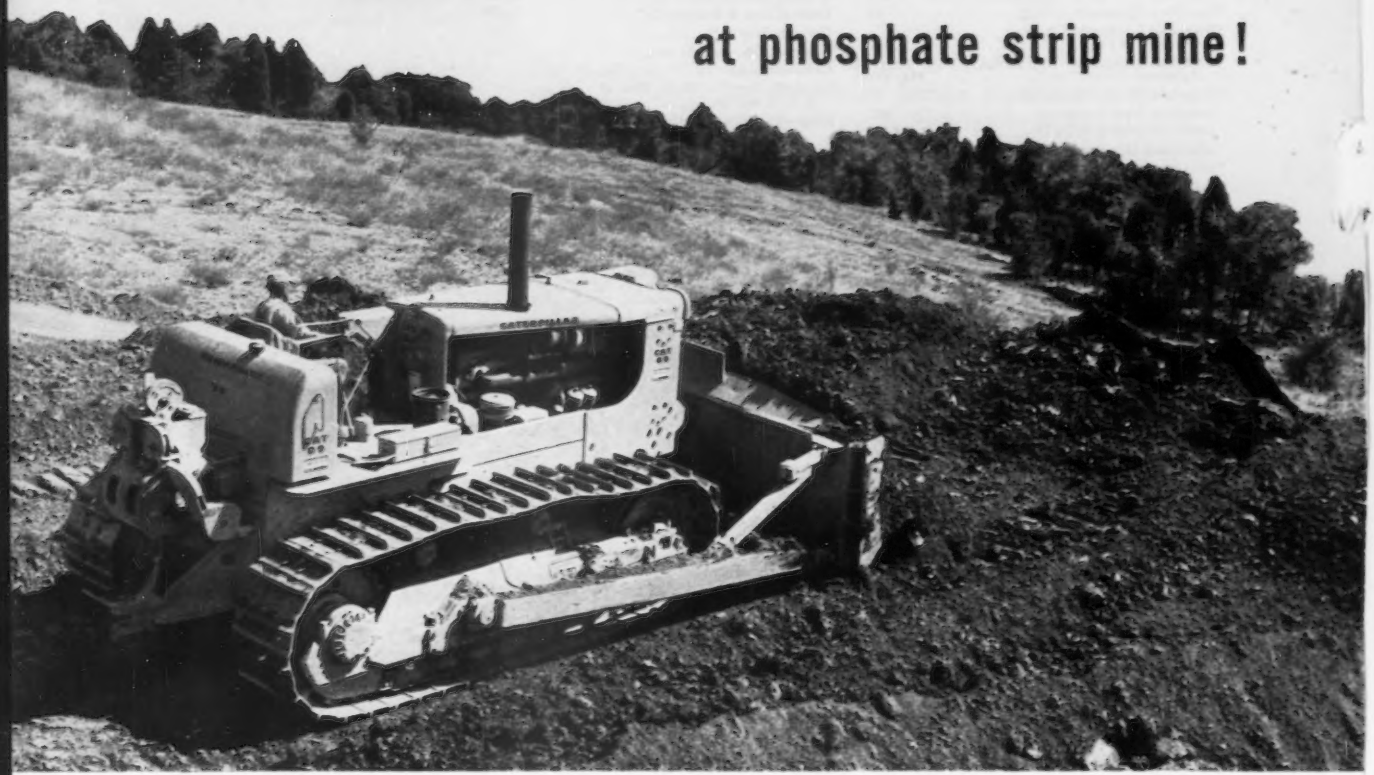
D9 DOZES 4,000 CU. YD. OF OVERBURDEN PER 10-HOUR DAY

at phosphate strip mine!



Here's the remarkable record being made by this giant CAT* D9 Tractor with No. 9S Bulldozer on a phosphate strip mine near Columbia, Tennessee:

—Averages 16 cu. yd. per 150-ft. pass dozing overburden to spoil bank.

—Makes 25 passes per hour, working a 10-hour day.

—*Total: 4,000 cu. yd. of overburden moved daily.*

And this king-sized production output is not the whole story. The D9 benches for a 3-yd. Lima dragline—working ahead maintaining a 15 to 18-ft. shelf for dragline footing.

No wonder Malcolm C. West, owner of the mining contracting firm on this operation, says: "You need a volume of overburden to make a profit—and I think the D9 is the only dozer capable of doing the job."

That's the story at mine after mine. When the D9 goes into action, owners wonder how they ever got along without it! Dozing, the D9 can sometimes outwork 2 bulldozers of the next smaller size. With its massive weight and 320 HP at the flywheel, the D9 digs in and pushes bigger loads faster than many new users had believed possible.

Your Caterpillar Dealer is ready to show *you* on your job exactly how the Caterpillar D9 Tractor can give you high production at low cost per yard. And he's ready, too, to stand behind the long life of this dependable machine with prompt, reliable service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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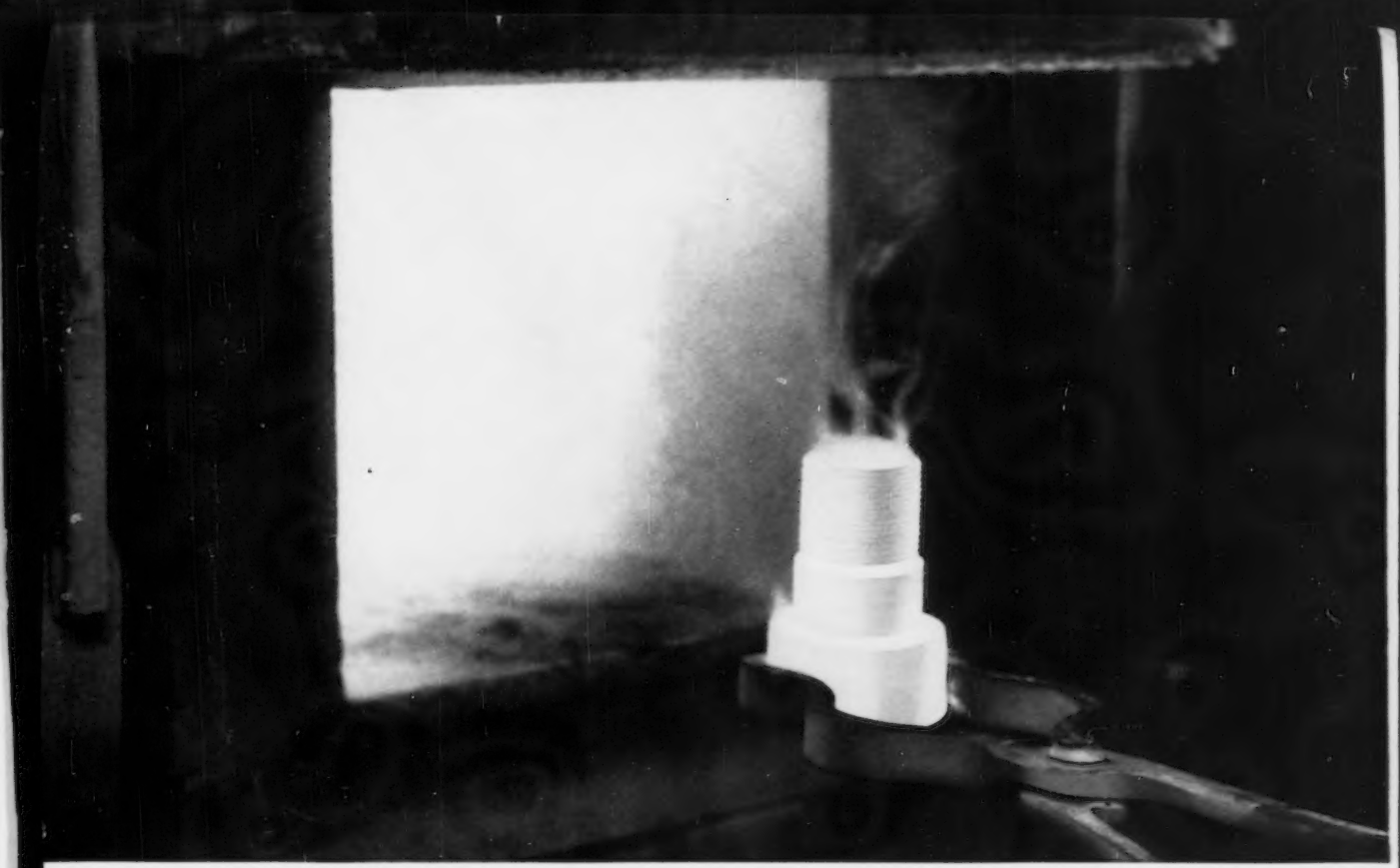
THE HARD WORK



Little Furnace
Makes Money for You

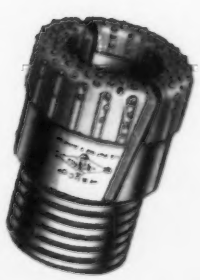
But for this little furnace you wouldn't be getting the irresistible cutting power or the footage or the diamond salvage that Truco Bits deliver today.

When our metallurgists developed our patented system for anchoring diamonds nearly twenty years ago, part of the secret lay in the sintering process by which diamonds were anchored in a solid, tough, metal bed which also developed a chemical bond with the diamonds and held them in a vise-like grip that was the wonder of the industry.

The sintering demanded precise control and these electric ovens were developed to sinter the powdered metal bed and bit blank into a solid amalgam without injuring the diamonds and without allowing them to move from their carefully set position, each with "best face to the work" for maximum cutting power.

Metals produced by this process cling to diamonds through toughest abrasive conditions and when the bit is finally pulled, there are more salvable diamonds there than you have any right to expect, except in a Truco.

That's one of the reasons why Truco Bits cost less. Try a Truco and see for yourself.



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WHEEL TRUEING TOOL COMPANY

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WHEEL TRUEING TOOL CO. OF CANADA, LTD.
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America's leading industrial diamond importers for nearly half a century

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TIME and time again, machinery makers come to the Timken Company for help with some special bearing application problem. One they think hasn't been solved before. And time after time, from our 30 types and 10,247 sizes of Timken® tapered roller bearings, we've come up with the bearing design to do the job and at minimum cost.

It's no accident that we can help out so often. In over 50 years of helping machinery builders with bearing problems, we've engineered and produced the world's largest selection of tapered roller bearings. And we've constantly improved our designs. The answers to thousands of bearing application problems are already in our files. Ready and available to help you.

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